NEW SYLLABUS MATHEMATICS 2 (6th Edition)
Specific Instructional Objectives (SIOs)

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SET A

This file contains a specified/suggested teaching schedule for the teachers.

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Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
Term 1 **Week 1, 2 & 3**	**Chapter 1** **Congruence and Similarity**	• Identify congruent figures and objects and use the correct notations to express congruency. • Find unknown values in a pair of congruent figures. • Identify similar figures and objects and use the correct notations to express similarity. • State the properties of a pair of similar figures and use these properties to find the unknowns in a pair of similar figures. • Use similarity properties to make scale drawings of simple objects or places such as a field, a school hall, etc. • Calculate the actual length and the actual area from a given scale model and vice versa. • Express the scale of a map as a representative fraction and vice versa and use it to calculate the distance between two places. • Calculate the actual dimensions of a place on a map and vice versa. • Calculate the actual area of places such as parks, villages, etc., on a map and vice versa. • Solve map problems involving distance and area of a place.	1a 1a 1b 1b 1c	Pg 4: What other living examples are there around you that are similar or congruent?	Pg 11, 15	Pg 3, 20, 21			Textbook
Term 1 **Week 4 & 5**	**Chapter 2** **Direct and Inverse Proportion**	• Write down an equation connecting two quantities which are directly proportional to each other and use the rule to solve problems involving direct proportion. • Sketch the graph connecting two quantities which are directly	2a	Pg 37: Oral discussion for the need of rules when using the library. What new rules will be	Pg 48, 53, 61	Pg 58, 66			Textbook

Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
		proportional to each other. • Write down an equation connecting two quantities which are inversely proportional to each other and use the rule to solve problems involving inverse proportion. • Sketch the graph connecting two quantities which are inversely proportional to each other. • Solve simple problems involving direct or inverse proportions.	2b, 2c 2d, 2e, 2f	useful for a more effective use of the library?					
Term 1 **Week 5, 6, 7 & 8**	**Chapter 3** **Expansion and Factorisation of Algebraic Expressions**	• Perform expansion of algebraic expressions of the form $(a \pm b)(c \pm d)$ and $(a \pm b)(c \pm d \pm e)$. • State the identities for the expansion of perfect squares $(a \pm b)^2$, and the expansion of $(a + b)(a - b)$. • Perform expansions of algebraic expressions using the rules above. • Evaluate numerical expressions using the identities learnt earlier. • Factorise algebraic expressions by picking out the common factor. • Factorise expressions using the algebraic identities involving perfect squares and difference of squares learnt earlier. • Evaluate numerical expressions using factorisation. • Factorise quadratic expressions.	3b 3c 3c 3d 3e 3e 3f		Pg 84: Find out more about Pascal Triangle using the internet.	Pg 74, 100, 103, 107			Textbook

Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
		• Solve quadratic equations by factorisation. • Express word problems in the form of quadratic equations and solve these problems by factorisation.	3g 3h						
Term 1 **Week 9 & 10** **&** **Term 2** **Week 1 & 2**	**Chapter 4** **Algebraic Manipulation and Formulae**	• State the two important rules in the manipulation of fractions: $\frac{a}{b} = \frac{a\times c}{b\times c}$, and $\frac{a}{b} = \frac{a\div b}{b\div c}$. • Simplify simple algebraic fractions involving single terms using the rules shown above. • Simplify algebraic fractions with polynomials by using factorisation and using the rules learnt above. • Perform multiplication and division of simple algebraic fractions. • Find the HCF and LCM of algebraic expressions. • Perform addition and subtraction of simple algebraic expressions. • Solve simple equations involving algebraic fractions. • Express problems that involve algebraic fractions in the form of equations and solve them. • Change the subject of a simple formula. • Changing the subject of a formula involving squares, square roots, cubes and cube roots etc.	 4a 4b 4c, 4d 4e, 4f 4g 4h 4i 4j		Pg 125	Pg 121, 127, 128, 133, 138, 139, 143			Textbook

Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
		• Finding the unknown in a formula.	4k						
Term 2 **Week 3 & 4**	**Chapter 5** **Simultaneous Linear Equations**	• Solve a pair of simultaneous equations by the elimination method. • Solve a pair of simultaneous linear equations by adjusting the coefficients of one similar variable of both equations to be equal before elimination. • Solve a pair of simultaneous linear equations by using the substitution method. • Solve a pair of simultaneous linear equations by either the elimination or the substitution method. • Express word problems into the form of a pair of simultaneous linear equations and using either the elimination or substitution method to solve the problem.	5a 5b 5c 5c 5d		Pg 170	Pg 164-165 Pg 157, 171			Textbook
Term 2 **Week 5, 6 & 7**	**Chapter 6** **Pythagoras' Theorem**	• Identify a right-angled triangle and its hypotenuse. • Define the Pythagoras' theorem and its converse and use proper symbols to express the relationship. • Apply the Pythagoras' theorem to find the unknown side of a right-angled triangle when the other two sides are given. • Solve word problems involving right-angled triangles using Pythagoras' theorem.	6a 6a 6b 6b		Pg 178 Pg 181: Find out how mathematics and music are related, how computer music are made, etc. Pg 185: Find out more about Pythagorean Triples.				Textbook

Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
Term 3 **Week 1, 2 & 3**	**Chapter 7** **Volume and Surface Area**	• State the formula for the volume of a pyramid and use it to solve related problems. • Sketch a pyramid and draw its net and use it to find the surface area of a pyramid. • State the formulae for the volume, curved surface area and the total surface area of a cone and use these formulae to solve related problems. • State the formulae for the volume and surface area of a sphere and use them to solve related problems. • Solve problems involving cones, prisms, pyramids, cylinders and/or spheres.	7a 7a 7b 7c		Pg 199-201, 211, 220-221, 223		Pg 233 Review Questions 7 Q11 & Q12		Textbook
Term 3 **Week 4, 5 & 6**	**Chapter 8** **Graphs of Linear Equations in Two Unknowns**	• Select appropriate scales for drawing graphs. • Construct a table of values for x and y for a given linear equation. • Plot the points given/found on a Cartesian plane. • Identify $y = c$ as the equation of a straight line graph drawn passing through a point (h, c) where h is any constant, and parallel to x-axis. • Identify $x = a$ as the equation of a straight line graph drawn passing through a point (a, k) where k is any constant and parallel to y-axis.	8a 8a 8a 8b 8b	Discuss the proper choice of scale.	Pg 240, 241, 250	Pg 250		Graph-matica: Pg 244, 246, 252	Textbook

Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
		• Identify $y = mx$ as the equation of a straight line graph passing through the origin (0, 0) and which rises from left to right when m has a positive value and falls from left to right when m has a negative value. • Identify $y = mx + c$ as the equation of a straight line graph passing through the point (0, c) and which rises from left to right when m has a positive value and falls from left to right when m has a negative value. • Solve a pair of simultaneous linear equations using the graphical method.	8c 8c 8d						
Term 3 **Week 6, 7 & 8**	**Chapter 9** **Graphs of Quadratic Functions**	• Identify important features of quadratic graphs $y = ax^2$ when a takes on positive and negative values. • Construct a table of values for x and y for a quadratic function. • Plot a quadratic graph from a table of values with/without the aid of a curved rule. • Identify the equation of a line of symmetry of a quadratic graph. • Find the values of x and y from the quadratic graph by locating the point/s of intersection of a graph and a straight line. • Express word problems into quadratic equation and solve the problem using graphical method.	9a 9a 9a 9b 9b		Pg 261-262, 264-265	Pg 263, 264		Graph-matica: Pg 262	Textbook
Term 3 **Week 9 & 10**	**Chapter 10** **Set Language and Notation**	• Define the term ‘set’. • Write a statement using proper set notations and symbols. • Use Venn diagrams to represent a set.	10a 10a	The origin and use of sets.	Pg 290	Pg 296, 302	Pg 290 Activity B		Textbook

Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
		• Define and identify an empty set and universal set. • Define and identify equal sets, disjoint set and complement of a set and to give examples of these sets. • Define and distinguish subsets and proper subsets of a given set. • Define the intersection and union of sets and the relationships between sets by using Venn diagrams. • Use Venn diagrams to solve problems involving classification and cataloguing.	10b 10c 10d						
Term 4 **Week 1, 2 & 3**	**Chapter 11** **Statistics**	• Collect and organise data logically and present it in the form of a table. • Illustrate a given set of information by drawing a pie chart and a bar chart (Revision). • Illustrate a given set of information by drawing (i) dot diagram, (ii) stem & leaf diagram and to interpret these graphs. • Define the mode and find its value for a set of data. • Define the mean and median for a set of data and determine their values for a set of data. • Distinguish the different purposes for which the mean, median and mode are used. • Find the mean of a set of grouped data.	11a 11b 11b 11b	Discuss misleading data/ statistical information on pg 327. When are mode, mean and median best be used?			Pupils may obtain social facts about the society.		Textbook

Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
		• Solve more difficult problems involving mean, median and mode.	11c						
Term 4 **Week 4, 5 & 6**	**Chapter 12** **Probability**	• Define experiments and sample space. • Define the classical definition of probability of an event E occurring as P(E)= $\frac{\text{No. of Favourable Outcomes for Event E}}{\text{No. of Possible Outcomes}}$ • Use the above results to calculate the probability of occurrence of simple events. • Define the experimental probability of the event E happening as P(E)= $\frac{\text{No. of times event E occurs}}{\text{Total No. of times of performing the experiment}}$ • Use the above results to calculate the probability of occurrence of simple events. • State that for any event E, $0 \le P(E) \le 1$. • P(E)=0 if and only if the event E cannot possibly occur. • P(E)=1 if and only if the event E will certainly occur.	12a 12b	Discuss "Is it worthwhile to gamble? What are the odds? Is it better to bet on 4-digit 'BIG' or 'SMALL'?" *NE* Refer to TG on Singapore Pools. Pg 363: The origin of development of probability.	Pg 367-368	Pg 362			Textbook

NEW SYLLABUS MATHEMATICS 1 & 2 (6th Edition)
Specific Instructional Objectives (SIOs) for Normal (Academic) Level

SET A

This file contains a specified/suggested teaching schedule for the teachers.

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Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
Term 1 **Week 1, 2 & 3**	**Chapter 7 Of Book 1** **Algebraic Equations and simple Inequalities**	• Solve simple algebraic equations by inspection. • State the rules for solving algebraic equations: (a) equal numbers may be added or subtracted to/from each side, (b) each side may be multiplied or divided by equal numbers except zero. • Use the above rules to solve simple algebraic equations. • Use the rules to solve algebraic equations involving fractions and decimals. • Find the value of an unknown in a formula by substitution. • Construct simple formulae from given word expressions. • Express word expressions by algebraic methods. • Solve algebraic word problems using the various problem solving heuristics. • Use the symbols =, < or > correctly. • State and use the rules of simple inequality in problems.	7a 7b 7c 7d 7e 7f 7g, 7h 7i 7j		Pg 159-161	Pg 141, 153, 155, 161			Textbook
Term 1 **Week 4 & 5**	**Chapter 12 Of Book 1** **Functions and Graphs**	• Locate a point on a coordinate plane. • Draw a graph of a function. • Find the gradient of a straight line.	12a 12b 12b		Pg 279, 280-282	Pg 270, 278			Textbook

Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
Term 1 **Week 6 & 7**	**Chapter 16 Of Book 1** **Geometrical Constructions**	• Construct the perpendicular bisector and angle bisector using compasses and a ruler. • Construct a triangle from given data using compasses, a ruler or a protractor. • Construct a quadrilateral from given data using compasses, a ruler or a protractor.	16a 16a 16b		Pg 384, 387, 394	Pg 385, 392			Textbook
Term 1 **Week 8, 9 & 10**	**Chapter 1 Of Book 2** **Congruence and Similarity**	• Identify congruent figures and objects and use the correct notations to express congruency. • Find unknown values in a pair of congruent figures. • Identify similar figures and objects and use the correct notations to express similarity. • State the properties of a pair of similar figures and use these properties to find the unknowns in a pair of similar figures. • Use similarity properties to make scale drawings of simple objects or places such as a field, a school hall, etc. • Calculate the actual length and the actual area from a given scale model and vice versa. • Express the scale of a map as a representative fraction and vice versa and use it to calculate the distance between two places. • Calculate the actual dimensions of a place on a map and vice versa.	1a 1a 1b 1b 1c	Pg 4: What other living examples are there around you that are similar or congruent?	Pg 11, 15	Pg 3, 20, 21			Textbook

Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
		• Calculate the actual area of places such as parks, villages, etc., on a map and vice versa. • Solve map problems involving distance and area of a place.							
Term 2 **Week 1, & 2**	**Chapter 2 Of Book 2** **Direct and Inverse Proportion**	• Write down an equation connecting two quantities which are directly proportional to each other and use the rule to solve problems involving direct proportion. • Sketch the graph connecting two quantities which are directly proportional to each other. • Write down an equation connecting two quantities which are inversely proportional to each other and use the rule to solve problems involving inverse proportion. • Sketch the graph connecting two quantities which are inversely proportional to each other. • Solve simple problems involving direct or inverse proportions.	2a 2b, 2c 2d, 2e, 2f	Pg 37: Oral discussion for the need of rules when using the library. What new rules will be useful for a more effective use of the library?	Pg 48, 53, 61	Pg 58, 66			Textbook
Term 2 **Week 3, 4, 5 & 6**	**Chapter 3 Of Book 2** **Expansion and Factorisation of Algebraic Expressions**	• Perform expansion of algebraic expressions of the form $(a \pm b)(c \pm d)$ and $(a \pm b)(c \pm d \pm e)$. • State the identities for the expansion of perfect squares $(a \pm b)^2$, and the expansion of $(a + b)(a – b)$. • Perform expansions of algebraic expressions using the rules above. • Evaluate numerical expressions using the identities learnt earlier.	3b 3c 3c 3d		Pg 84: Find out more about Pascal Triangle using the internet.	Pg 74, 100, 103, 107			Textbook

Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
		• Factorise algebraic expressions by picking out the common factor. • Factorise expressions using the algebraic identities involving perfect squares and difference of squares learnt earlier. • Evaluate numerical expressions using factorisation. • Factorise quadratic expressions. • Solve quadratic equations by factorisation. • Express word problems in the form of quadratic equations and solve these problems by factorisation.	3e 3e 3f 3g 3h						
Term 2 **Week 7 & 8** **&** **Term 3** **Week 1 & 2**	**Part of Chapter 4 Of Book 2** **Algebraic Manipulation and Formulae**	• State the two important rules in the manipulation of fractions: $\frac{a}{b} = \frac{a \times c}{b \times c}$, and $\frac{a}{b} = \frac{a \div b}{b \div c}$. • Simplify simple algebraic fractions involving single terms using the rules shown above. • Simplify algebraic fractions with polynomials by using factorisation and using the rules learnt above. • Perform multiplication and division of simple algebraic fractions. • Find the HCF and LCM of algebraic expressions. • Perform addition and subtraction of simple algebraic expressions.	4a 4b 4c, 4d 4e, 4f		Pg 125	Pg 121, 127, 128, 133			Textbook

Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
		• Solve simple equations involving algebraic fractions. • Express problems that involve algebraic fractions in the form of equations and solve them.	4g 4h						
Term 3 **Week 3 & 4**	**Chapter 5 Of Book 2** **Simultaneous Linear Equations**	• Solve a pair of simultaneous equations by the elimination method. • Solve a pair of simultaneous linear equations by adjusting the coefficients of one similar variable of both equations to be equal before elimination. • Solve a pair of simultaneous linear equations by using the substitution method. • Solve a pair of simultaneous linear equations by either the elimination or the substitution method. • Express word problems into the form of a pair of simultaneous linear equations and using either the elimination or substitution method to solve the problem.	5a 5b 5c 5c 5d		Pg 170	Pg 164-165 Pg 157, 171			Textbook
Term 3 **Week 5, 6, & 7**	**Chapter 7 Of Book 2** **Volume and Surface Area**	• State the formula for the volume of a pyramid and use it to solve related problems. • Sketch a pyramid and draw its net and use it to find the surface area of a pyramid. • State the formulae for the volume, curved surface area and the total surface area of a cone and use these formulae to solve related problems.	7a 7a 7b		Pg 199-201, 211, 220-221, 223		Pg 233 Review Questions 7 Q11 & Q12		Textbook

Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
		• State the formulae for the volume and surface area of a sphere and use them to solve related problems. • Solve problems involving cones, prisms, pyramids, cylinders and/or spheres.	7c						
Term 3 **Week 8, 9, & 10**	**Chapter 8 Of Book 2** **Graphs of Linear Equations in Two Unknowns**	• Select appropriate scales for drawing graphs. • Construct a table of values for *x* and *y* for a given linear equation. • Plot the points given/found on a Cartesian plane. • Identify $y = c$ as the equation of a straight line graph drawn passing through a point (h, c) where *h* is any constant, and parallel to *x*-axis. • Identify $x = a$ as the equation of a straight line graph drawn passing through a point (a, k) where *k* is any constant and parallel to *y*-axis. • Identify $y = mx$ as the equation of a straight line graph passing through the origin (0, 0) and which rises from left to right when *m* has a positive value and falls from left to right when *m* has a negative value. • Identify $y = mx + c$ as the equation of a straight line graph passing through the point $(0, c)$ and which rises from left to right when *m* has a positive value and falls from left to right when *m* has a negative value. • Solve a pair of simultaneous linear equations using the graphical method.	8a 8a 8a 8b 8b 8c 8c 8d	Discuss the proper choice of scale.	Pg 240, 241, 250	Pg 250		Graph-matica: Pg 244, 246, 252	Textbook

Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
Term 4 **Week 1, 2 & 3**	**Chapter 11 Of Book 2** **Statistics**	• Collect and organise data logically and present it in the form of a table. • Illustrate a given set of information by drawing a pie chart and a bar chart (Revision). • Illustrate a given set of information by drawing (i) dot diagram, (ii) stem & leaf diagram and to interpret these graphs. • Define the mode and find its value for a set of data. • Define the mean and median for a set of data and determine their values for a set of data. • Distinguish the different purposes for which the mean, median and mode are used. • Find the mean of a set of grouped data. • Solve more difficult problems involving mean, median and mode.	11a 11b 11b 11b 11c	Discuss misleading data/ statistical information on pg 327. When are mode, mean and median best be used?			Pupils may obtain social facts about the society.		Textbook
Term 4 **Week 4, 5 & 6**	**Chapter 12 Of Book 2** **Probability**	• Define experiments and sample space. • Define the classical definition of probability of an event E occurring as $P(E)=\frac{\text{No. of Favourable Outcomes for Event E}}{\text{No. of Possible Outcomes}}$ • Use the above results to calculate the probability of occurrence of simple events.	12a	Discuss “Is it worthwhile to gamble? What are the odds? Is it better to bet on 4-digit ‘BIG’ or ‘SMALL’?” *NE* Refer to TG on Singapore Pools. Pg 363: The	Pg 367-368	Pg 362			Textbook

Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
		• Define the experimental probability of the event E happening as P(E)= $\frac{\text{No. of times Event E occurs}}{\text{Total No. of times of performing the experiment}}$ • Use the above results to calculate the probability of occurrence of simple events. • State that for any event E, $0 \le P(E) \le 1$. • P(E)=0 if and only if the event E cannot possibly occur. • P(E)=1 if and only if the event E will certainly occur.	12b	origin of development of probability.					
For Sec 3N(A)	**Chapter 6 Of Book 2** **Pythagoras' Theorem**	• Identify a right-angled triangle and its hypotenuse. • Define the Pythagoras' theorem and its converse and use proper symbols to express the relationship. • Apply the Pythagoras' theorem to find the unknown side of a right-angled triangle when the other two sides are given. • Solve word problems involving right-angled triangles using Pythagoras' theorem.	6a 6a 6b 6b		Pg 178 Pg 181: Find out how mathematics and music are related, how computer music are made etc. Pg 185: Find out more about Pythagorean Triples.				Textbook

Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
For Sec 3N(A)	**Chapter 9 Of Book 2** **Graphs of Quadratic Equations**	• Identify important features of quadratic graphs $y = ax^2$ when a takes on positive and negative values. • Construct a table of values for x and y for a quadratic function. • Plot a quadratic graph from a table of values with/without the aid of a curved rule. • Identify the equation of a line of symmetry of a quadratic graph. • Find the values of x and y from the quadratic graph by locating the point/s of intersection of a graph and a straight line. • Express word problems into quadratic equation and solve the problem using graphical method.	9a 9a 9a 9b 9b		Pg 261-262, 264-265	Pg 263, 264		Graph-matica: Pg 262	Textbook
For Sec 4N(A)	**Part of Chapter 4 Of Book 2** **Algebraic Manipulation and Formulae**	• Change the subject of a simple formula. • Changing the subject of a formula involving squares, square roots, cubes and cube roots etc. • Finding the unknown in a formula.	4i 4j 4k			Pg 138, 139, 143			Textbook
For Sec 5N(A)	**Chapter 10 Of Book 2** **Set Language and Notation**	• Define the term 'set'. • Write a statement using proper set notations and symbols. • Use Venn diagrams to represent a set. • Define and identify an empty set and universal set.	10a 10a 10b	The origin and use of sets.	Pg 290	Pg 296, 302	Pg 290 Activity B		Textbook

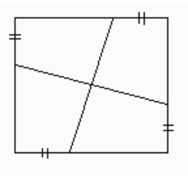
Week	Topic	Specific Instructional Objectives	Exercises	Maths Communication	Maths Investigation	Problem Solving	NE	IT	Resources
		• Define and identify equal sets, disjoint set and complement of a set and to give examples of these sets. • Define and distinguish subsets and proper subsets of a given set. • Define the intersection and union of sets and the relationships between sets by using Venn diagrams. • Use Venn diagrams to solve problems involving classification and cataloguing.	10c 10d						

Chapter 1

Secondary 2 Mathematics
Chapter 1 Congruence and Similarity

ANSWERS FOR ENRICHMENT ACTIVITIES

Just For Fun (pg 3)



Secondary 2 Mathematics
Chapter 1   Congruence and Similarity

GENERAL NOTES

Some IQ test questions require candidates to identify the odd picture or shape when 5 seemingly identical pictures or shapes are given. Many quiz questions in children's magazines also have two seemingly identical pictures and the children are supposed to spot the differences. This could serve as an introduction to this chapter. The above mentioned points touch on the notion of congruence. The first involves identifying the 4 congruent figures and the odd one out. The second involves identifying shapes or parts that are not congruent.

Most students are aware that many toys come in different sizes but are similar. We can ask them to name some other objects that are similar in their surroundings. The Exploration activity on page 4 will be a good starting point.

Common Errors Made By Students

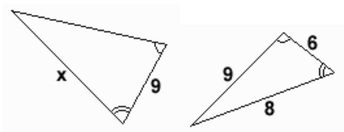
Many students label similar and congruent figures wrongly. If $\angle A = \angle E$, $\angle B = \angle D$ and $\angle C = \angle F$, then $\Delta\, \boldsymbol{ABC}$ is similar to $\Delta\, \boldsymbol{DEF}$, not correctly as $\Delta\, \boldsymbol{EDF}$.

XYZ SECONDARY SCHOOL

Name: _________________ (   )   Date: ____________
                                        Time allowed: min
Class: _______   Marks: $\frac{\ \ }{16}$

Secondary 2 Multiple-Choice Questions
Chapter 1 Congruence and Similarity

1. In the diagram, the two triangles are similar. The value of ***x*** is ______.



(**A**) 6 (**B**) 7 (**C**) 8 (**D**) 9 (**E**) 12 (   )

2. Which of the following family of plane figures must have members which are all similar?

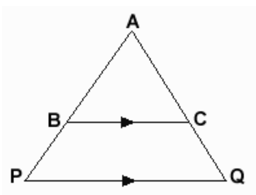
I all rhombuses II all regular hexagons III all kites

(**A**) I only (**B**) II only (**C**) III only

(**D**) I and II only (**E**) all of the above (   )

3. In the figure, if ΔABC is similar to ΔAPQ and $AB = 3BP$, then the ratio $BC : PQ$ is ______.

(**A**) 1 : 3 (**B**) 1 : 4 (**C**) 1 : 5 (**D**) 3 : 4 (**E**) 3 : 5 (   )



4. Which of the following statements is/are true of two polygons?

I The polygons are congruent if they are similar.

II The polygons are similar if their corresponding angles are equal.

III The polygons are similar if their corresponding sides are proportional.

(**A**) I only (**B**) II only (**C**) III only

(**D**) I and II (**E**) II and III (   )

5. If two polygons are similar, then

(**A**) their corresponding angles and sides are equal.
(**B**) their corresponding angles and sides are proportional.
(**C**) their corresponding angles are proportional and their corresponding sides are equal.
(**D**) their corresponding angles are equal and their corresponding sides are proportion.
(**E**) none of the above statements is true. ( )

6. Which of the following statements is/are true about any two similar triangles?

I Two triangles are congruent if they are similar.
II Two triangles are similar if their angles are equal.
III Two triangles are similar if their sides are proportional.

(**A**) I and II (**B**) II and III (**C**) I and III
(**D**) I, II and III (**E**) none of the above are true ( )

7. On a map of scale 1 : ***n***, the area of a field 400m^2 is represented by an area of 1 cm^2 on the map. Find ***n***.

(**A**) 20 (**B**) 200 (**C**) 400 (**D**) 2000 (**E**) 40000 ( )

8. The area of a forest on a map is 9 cm^2. If the scale of the map is 1 : 200000, its actual area is ______.

(**A**) 3.6 km^2 (**B**) 18 km^2 (**C**) 36 km^2
(**D**) 180 km^2 (**E**) 3600 km^2 ( )

9. On a map drawn on a scale of 2 cm to represent $\frac{1}{2}$ km, what length on the map will represent a road 240 m long?

(**A**) 0.48 cm (**B**) 0.96 cm (**C**) 4.8 cm (**D**) 9.6 cm (**E**) 19.2 cm ( )

10. On a map of R.F. 1 : 20000, a housing estate occupies an area of 100 cm^2. On a map of R.F. 1 : 50000, the same housing estate will occupy an area of ______.

(**A**) 16 cm^2 (**B**) 40 cm^2 (**C**) 63.25 cm^2 (**D**) 500 cm^2 (**E**) 625 cm^2 ( )

11. The area of a place on a map drawn on a scale of 1 : 20000 is equal to $\frac{1}{4}$ of the area on another map drawn on a scale of 1 : ***n***. The value of ***n*** is ______.

(**A**) 5000 (**B**) 10000 (**C**) 40000 (**D**) 80000 (**E**) 100000 ( )

12. The scale of a map is 1cm : 3 km. What is the area in km^2 of a place measuring 2 cm by 3 cm on the map?

(**A**) 5 (**B**) 6 (**C**) 18 (**D**) 25 (**E**) 54 ( )

13. The scale on a map is 1 cm : $\frac{2}{5}$ km. A piece of land has an area of 16 square km. What area in cm^2 does it occupy on the map?

(**A**) 40 (**B**) $6\frac{2}{5}$ (**C**) 100 (**D**) $2\frac{14}{25}$ (**E**) 200 ( )

14. On a map of scale 1 cm : 600 m, two villages are 15.5 cm apart. What is the actual distance in km between the two villages?

(**A**) 93 (**B**) 930 (**C**) 9.3 (**D**) 12 (**E**) 15 ( )

15. The scale on a map is 1 cm represents 25000 cm. The length, in metres, of a bridge which is 0.88 cm on the map is ______.

(**A**) 22000 (**B**) 2200 (**C**) 220 (**D**) 22 (**E**) 2.2 ( )

16. The scale on a map is 1 cm represents 3000 cm. The area of a field which is 1.15 cm wide and 2.48 cm long on the map, is ______, correct to the nearest m^2.

(**A**) 8556 (**B**) 8557 (**C**) 2566 (**D**) 2567 (**E**) 257 ( )

Answers

1. E	**2.** B	**3.** D	**4.** E
5. D	**6.** B	**7.** D	**8.** C
9. B	**10.** A	**11.** B	**12.** E
13. C	**14.** C	**15.** C	**16.** D

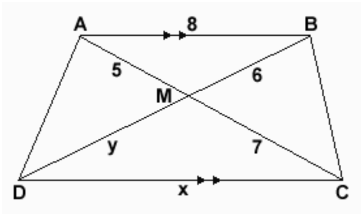
XYZ SECONDARY SCHOOL

Name: _________________ (   )   Date: ____________
Time allowed: min
Class: _______   Marks:

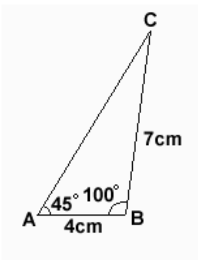
Secondary 2   Mathematics Test
Chapter 1   Congruence and Similarity

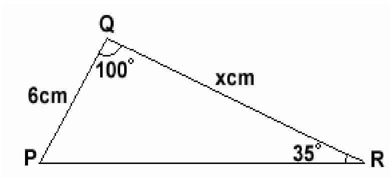
1. ΔPQR is similar to ΔABC. Given that PQ = 5 cm, QR = 4 cm and AB = 8 cm, calculate the length of BC. [3]

2. $ABCD$ is a trapezium where AB is parallel to DC. Name a pair of similar triangles. If AM = 5 cm, MC = 7 cm, BM = 6 cm, AB = 8 cm, DC = x cm and MD = y cm, find the values of x and y. [4]



3.



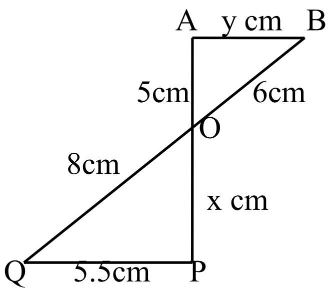


State, with reasons, whether ΔABC is similar to ΔPQR and find the value of x. [4]

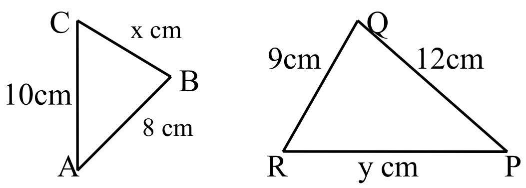
4. ΔOAB is similar to ΔOPQ.

(a) Explain clearly why AB is parallel to QP. [2]

(b) If OA = 5 cm, OB = 6 cm, OQ = 8 cm, QP = 5.5 cm, OP = x cm and AB = y cm, find the values of x and y. [3]



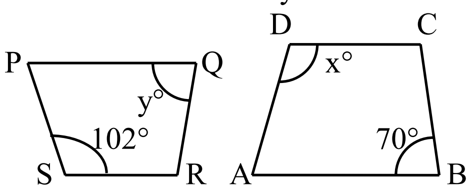
5. In the figure, ΔABC is similar to ΔPQR. Given that AB = 8 cm, AC = 10 cm, PQ =12 cm, QR = 9 cm, BC = x cm and PR = y cm, calculate the values of x and y. [3]



6. PQRS is similar to ABCD.

(a) Name three pairs of corresponding sides. [2]

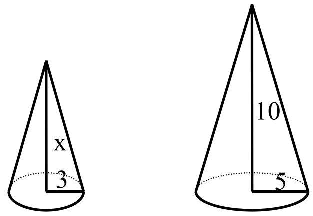
(b) Find the values of x and y. [2]



7. The figure shows two similar cones.

(a) Find the value of x. [1]

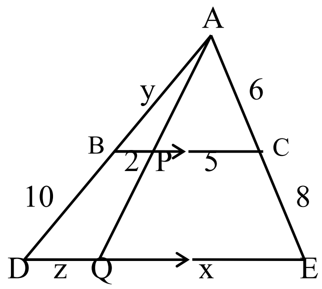
(b) What is the ratio of the base circumference of the smaller cone to that of the big cone? [2]



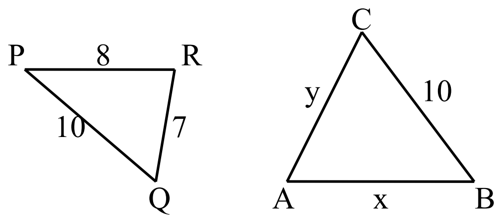
8. In the figure, BPC is parallel to DQE.

(a) Name three pairs of similar triangles. [3]

(b) If AC = 6 cm, CE = 8 cm, CP = 5 cm, BP = 2 cm and BD = 10 cm, find the values of x, y and z. [5]

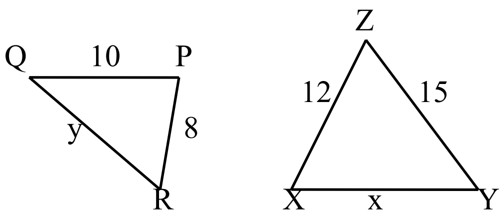


9. ΔABC is similar to ΔPRQ. Find the values of x and y. [3]

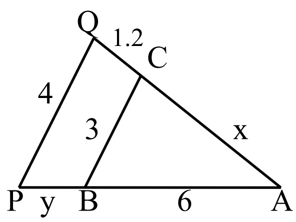


10. Given that ΔPQR is similar to ΔXYZ, calculate the values of x and y.

[4]



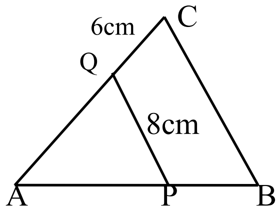
11. Given that ΔABC is similar to ΔAPQ, calculate the values of x and y. [4]



12. ΔAPQ is similar to ΔABC and AP : PB = 5 : 3. If PQ = 8 cm and QC = 6 cm, calculate the length

(a) BC, [2]

(b) AQ. [2]



13. A model of an apartment block is made to a scale of 1 : 50.

(a) Find the actual height of the apartment block if its height on the model is 42 cm. [1]

(b) If the area of the hall of the apartment is 34 m², find the area of the hall on the model. [2]

(c) If the area of a unit of the apartment is 1200 cm² on the model, find its actual area in m². [2]

14. On a map drawn on a scale of 2 cm to represent 300 m, what length on the map will represent a road 2.4 km long? A railway track on the map has a length of 14.5 cm. Find its actual length in km. [3]

15. A model of a building is made to a scale of 1 cm to 6 m.

(a) How tall is the model if the actual height of the building is 260 m? [1]

(b) The base area of the building is 5400 m². Find the base area of the building in the model. [2]

16. On a map the distance between two places A and B is 15 cm and the area of the Central Business District is 8 cm². If the scale of the map is 1 : 80000,

(a) find the actual distance of AB in km, [1]

(b) find the actual area of the Central Business District in km². [2]

17. The plans of a building are drawn to a scale of 1 : 150.

(a) Find the actual length, in metres, represented by 42 cm on the plan. [1]

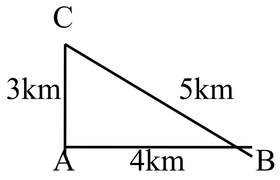
(b) The actual length of the diagonal of a hall is 33 m. Find its length, in cm, on the plan. [1]

(c) The area of a meeting room is 450 m². Find its area, in cm², on the plan. [2]

18. The diagram shows a triangle ABC where AB = 4 km, AC = 3 km and BC = 5 km. If ΔABC is drawn on a map of scale 1 : 50000, find

(a) the length of AB, in cm, on the map, [2]

(b) the area of ΔABC, in cm^{22},, on the map. [3]



19. A football stadium is represented by a scale of 1 cm to 8 m on paper.

(a) Find the actual length of the field if the length on the drawing is 28 cm. [1]

(b) The actual width of the stadium is 120 m. Find its width on the diagram. [1]

(c) If the area of the seating gallery is 960 m^2. Find its area on the drawing. [2]

20. The area scale of a map is 1 : 16000000. The length of two places A and B on the map is 8 cm and the area of a private housing estate is 12 cm^2.

(a) Find the linear scale of the map in the form 1 : n. [1]

(b) Find the actual distance of AB in metres. [1]

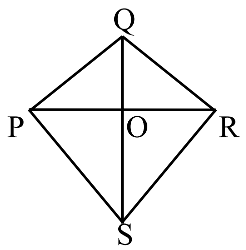
(c) What is the area of the private housing estate in hectares? [2]

21. The figure shows a kite PQRS whose diagonals intersect at O. Name a triangle that is congruent to

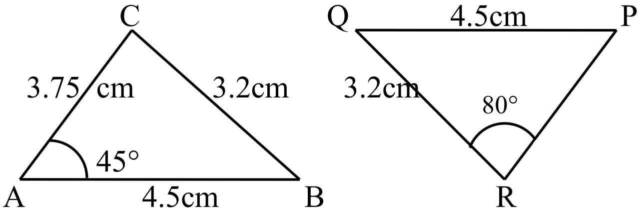
(a) ΔPOS, [1]

(b) ΔQOR, [1]

(c) ΔPQS. [1]



22.



ΔABC is congruent to ΔPQR. Copy and complete the following statements.

$\angle$BAC =__________ = 45° [1]

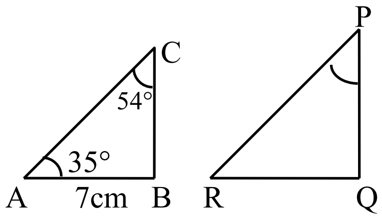
$\angle$PRQ =__________ = 80° [1]

AC =__________ = $3\frac{3}{4}$ cm [1]

23. Given that ΔABC is congruent to ΔPQR, find the value of

(a) $\angle$PQR,

(b) PQ. [2]



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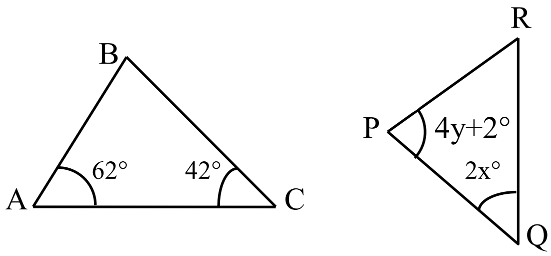
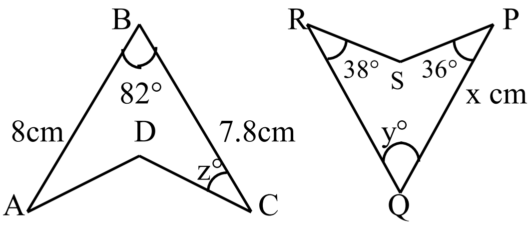


ΔABC is congruent to ΔPQR. Calculate

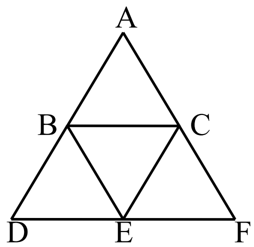
(a) x, [2]

(b) y. [2]

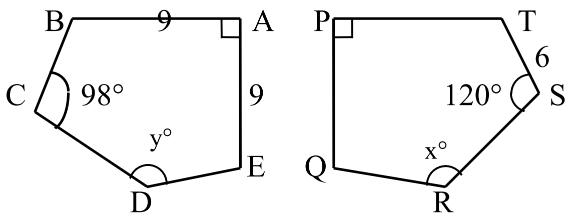
25. Given that ABCD is congruent to PQRS, find the values of x, y and z. [3]



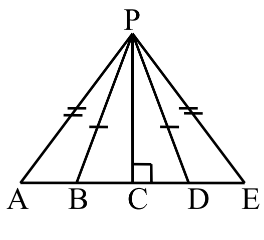
26. The figure shows 4 small equilateral triangles inside a big equilateral triangle.
(a) Name a pair of similar triangles. [1]
(b) Name two pairs of congruent triangles. [2]



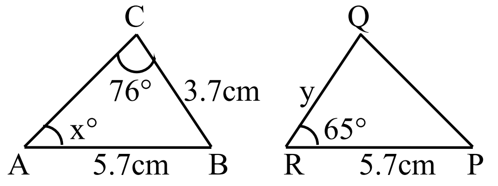
27. In the diagram ABCDE is congruent to PQRST.
(a) Find the values of x and y. [2]
(b) If the perimeter of ABCDE is 37 cm, find the values of BC and CD.
[2]



28. In the diagram, name 3 pairs of congruent triangles. [3]



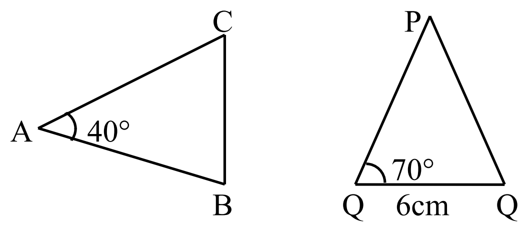
29. Given that ΔABC is congruent to ΔPRQ, find the values of x and y. [2]



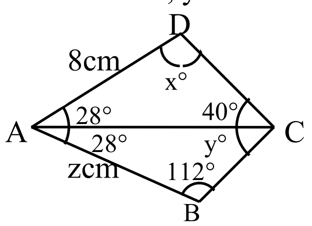
30. ΔABC is congruent to ΔPQR and QR = 6 cm.

(a) Find the value of $\angle ABC$ and $\angle PRQ$. [2]

(b) If the perpendicular length from A to BC is 9 cm, calculate the area of ΔPQR. [3]



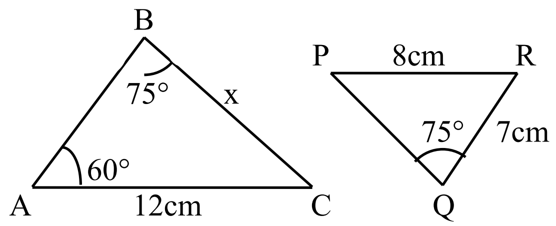
31. Find the values of x, y and z. [3]



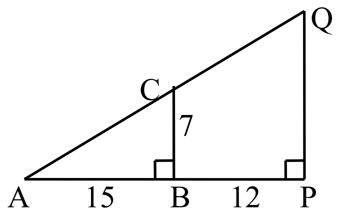
32. In the figure ΔABC is similar to ΔPQR, AC = 12 cm, PR = 8 cm and QR = 7 cm.

(a) Name an angle equal to $\angle PRQ$. [1]

(b) Calculate the length of BC. [2]



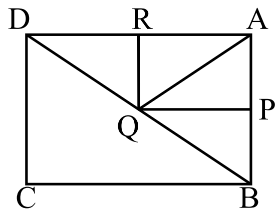
33. Given that AB = 15 m, BP = 12 m, BC = 7 cm and ΔABC is similar to ∠APQ, calculate the length of PQ. [3]



34. A lamp post of height 8 m casts a shadow 12 m long. Find the length of the shadow cast by a man of height 1.8 m tall. [3]

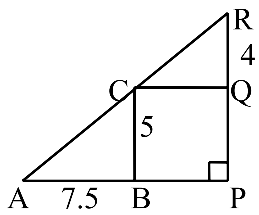
35. In the diagram APQR and ABCD are similar rectangles where AP = PB = 3 cm and BC = 8 cm and AQ = 5 cm.

(a) Name two pairs of congruent triangles. [2]
(b) Name two pairs of similar triangles. [2]
(c) Find the lengths of PQ and BD. [2]

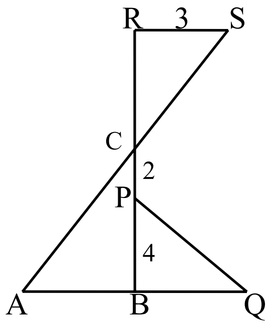


36. ΔABC, ΔCQR and ΔAPR are similar.

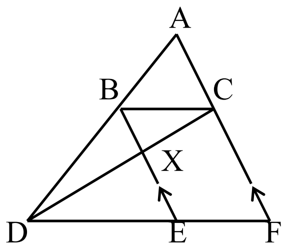
(a) Explain clearly why CQ is parallel to AP. [2]
(b) If BC = 5 cm, RQ = 4 cm and AB = 7.5 cm, calculate the lengths of AP and PR. [3]



37. In the figure ΔABC is congruent to ΔPBQ and ΔPBQ is similar to ΔSRC. If PB = 4 cm, PC = 2 cm and RS = 3 cm, find the lengths of AQ and BR. [4]



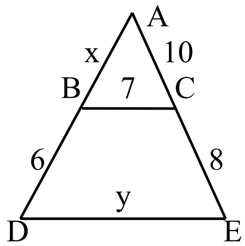
38. Name four pairs of similar triangles in the diagram. [4]



39. In the figure ΔABC is similar to ΔADE. Given that AB = x cm, DE = y cm, AC = 10 cm, CE = 8 cm, BD = 6 cm and BC = 7 cm. Find the values of

(a) x, [2]

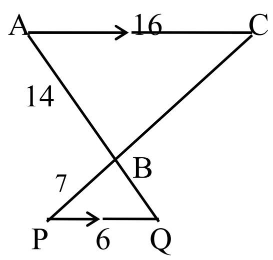
(b) y. [2]



40. In the figure ΔABC is similar to ΔQBP. Given that AC = 16 cm, PQ = 6 cm, AB = 14 cm and BP = 7 cm, calculate the length of

(a) BQ, [2]

(b) BC. [2]



41. ΔABD is similar to ΔDBC.

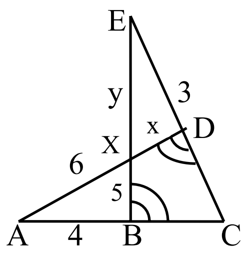
(a) Name two pairs of corresponding angles. [1]

(b) If BC = 6 cm, BD = 8 cm and CD = 10 cm, calculate the lengths of AB and AD. [3]

42. In the diagram ΔCDA is similar to ΔCBE.

(a) Name another pair of similar triangles. [1]

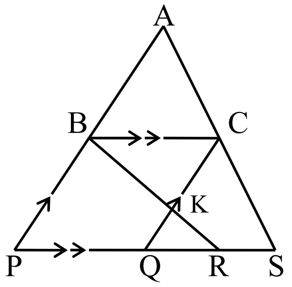
(b) If DE = 3 cm, AB = 4 cm, BX = 5 cm and AX = 6 cm, find the lengths of XD and XE. [4]



43. In the figure ΔABC is similar to ΔAPS and ΔSCQ is similar to ΔSAP.

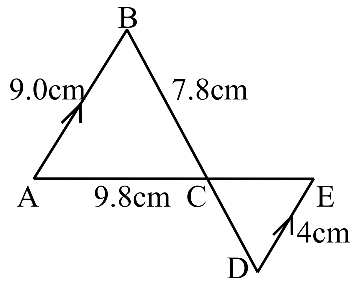
(a) Name another two pairs of similar triangles. [2]

(b) If PQ = 9 cm, QS = 12 cm and BP = 13 cm, find the length of AB. [2]



44. In the figure, ΔABC is similar to ΔEDC and that AB = 9.0 cm, AC = 9.8 cm, BC = 7.8 cm, DE = 4 cm, find the length of (a) CE, [2]

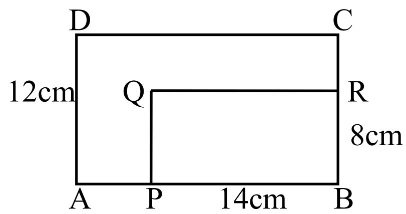
(b) CD. [2]



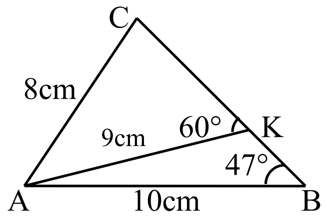
45. ABCD and PBRQ are two similar rectangles. If BR = 8 cm, PB = 14 cm and AD = 12 cm,

(a) find the length of AP, [2]

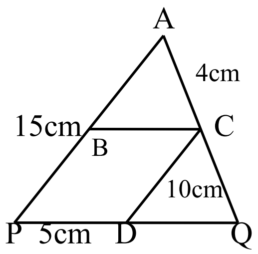
(b) find the ratio of $\dfrac{\text{area of PQRB}}{\text{area of ADCB}}$. [2]



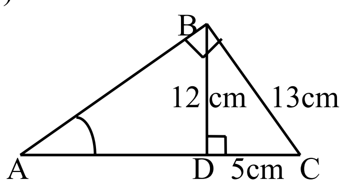
46. ΔABC is similar to ΔKAC. If $\angle ABC = 47°$, $\angle AKC = 60°$, AB = 10 cm, AK = 9 cm and AC = 8 cm, find
(a) $\angle BAC$ and $\angle KCB$, [3]
(b) the length of KB. [2]



47. Given that ΔABC is similar to ΔAPQ, ΔQCD is similar to ΔQAP. If CD = 10 cm, AP = 15 cm, AC = 4 cm and PD = 5 cm, calculate the length of
(a) CQ, [2]
(b) DQ. [3]



48. ΔABD is similar to ΔACB.
(a) Name another pair of similar triangles. [1]
(b) If BC = 13 cm, BD =12 cm and CD = 5 cm, calculate the lengths of
(i) AD,
(ii) AB. [4]



49. Given that 8 cm on a map represents 10 km on the ground, express the scale of the map in the form 1: n. [2]

50. On a scale drawing, the height of a block of flat is 8 cm. If the actual height of the block is 64 m, find the scale of the drawing in the form 1 : n. [2]

51. On a map drawn to a scale of 1 : 1250000, the distance between P and Q is 32.4 cm. What is the actual distance in km? [2]

52. On a map drawn to a scale of 4 cm to represent $\frac{1}{2}$ km, what length on the map will represent an MRT line 3.5 km long? [2]

53. The scale of a map is 4 cm to 1.2 km. Express the scale in the form 1: n. What is the area on the map

54. What is the R.F.of a map whose scale is 4 cm to 5 km? What is the area of a park on the map whose actual area is 12.5 km^2 ?

[3]

55. On a map whose scale is 1 : 40000, a housing estate is represented by an area of 25 cm^2. Find the area of the housing estate in hectares. [3]

56. If the scale of a map is 1 : 600000, what area on the map represents a country of 450 km^2 ? [3]

57. The distance 30 km between two towns P and Q is represented by a line of 4 cm on a map. If the scale of the map is 1 : 3x, find the value of x.

[2]

58. A map is drawn to a scale of 1 : 250000.
(a) Calculate the distance between two towns on the map if the actual distance is 125 km. [1]
(b) A road on the map has a length of 6 cm. Find its actual length on the ground. [1]
(c) An estate is represented by an area of 8 cm^2 on the map. Calculate the actual area of the estate in km^2. [2]

59. The scale of a map is 3 cm to 500 m.

(a) If the distance between two shopping centres on the map is 13.5 cm, calculate the actual distance in km. [2]

(b) A park has an area of 2.5 hectares. Find the area of the park on the map. [3]

60. 4 cm on the map represents 9 km on the ground.
(a) Calculate the distance in km between two towns which are 10 cm apart on the map [1]

(b) Express the scale of the map in the form 1 : n. [1]

(c) Calculate the area of a forest reserve in hectares which is represented by an area of 4 cm^2. [2]

61. A circular model baby pool is made using a scale of 1 cm to 2.5 m.
(a) The radius of the pool is 7.5 m. Find the radius of the model pool. [1]
(b) Find the area of the actual changing room if its area on the model is 8 cm^2. [2]

62. A railway track 6.4 km long is represented by a length of 8 cm on a map.
(a) Find the linear scale of the map. [1]
(b) What is the actual length of a road which is represented by a length of 11.5 cm on the map? [1]
(c) The area of a reservoir is represented by an area of 5 cm^2 on the map. Find the actual area of the reservoir in km^2. [2]

63. The area of a lake is 8 cm^2 drawn on a map of scale 1 : 50000.
(a) What is the area of the lake drawn on a map of scale 1 : 25000? [2]
(b) What is the area of the lake drawn on a map of scale 1 : 100000? [2]

64. The R.F. of a map is $\frac{1}{50000}$. The distance between two places P and Q on the map is 8.6 cm and the area of a playground on the map is 24 cm^2. Find
(a) the actual distance between P and Q, [1]

(b) the actual area of the playground in hectares. [3]

65. A map is drawn to a scale of 1 : 75000.
(a) The perimeter of a square lake on the map is 4.8 cm. Calculate the actual area of the lake in hectares. [2]

(b) The actual area of a park is 1.6 km^2. Find its area on the map. [2]

66. The distance between Algebricity and Statisticity is 14.5 cm on a map with an R.F. of $\frac{1}{200000}$. The area of the forest reserve in Algebricity is 16 cm^2. Find
(a) the actual distance, in km, between Algebricity and Statisticity, [1]

(b) the actual area, in km^2, of the forest reserve in Algebricity. [2]

67. The R.F. of a map is $\frac{1}{80000}$. Two places, Mathsland and Geometown, are 16.5 cm apart on the map and a park in Mathsland has an area of 25 cm^2 on the map. Find

(a) the actual distance between Mathsland and Geometown in km, [1]

(b) the actual area of the park in Mathsland in km^2. [2]

68. The area of a Theme Park on a map drawn to a scale of 1 : 35000 is equal to x cm^2. The same Theme Park on another map drawn to a scale of 1 : n is 4x cm^2. Find the value of n. [4]

69. On a map drawn to a scale of 1 : 40000, a country club occupies an area of 90 cm^2. What would be the area of the same country club on a map of scale 1 : 30000? [4]

Answers

1. $6\frac{2}{5}$

2. $\Delta \boldsymbol{ABM}$ and $\Delta \boldsymbol{CDM}$; $\boldsymbol{x} = 11\frac{1}{5}$, $\boldsymbol{y} = 8\frac{2}{5}$

3. $\hat{P} = 45°$, $\hat{C} = 35°$, $\therefore$ $\Delta \boldsymbol{ABC}$ is similar to $\Delta \boldsymbol{PQR}$, $\boldsymbol{x} = 10.5$

4. (a) $\angle Q = \angle B$ and they form alternate angles, AB // QP.
   (b) $x = 6\frac{2}{3}$, $y = 4\frac{1}{8}$

5. $x = 6$, $y = 15$

6. (a) PQ = AB , QR = BC , CD = RS
   (b) $x = 102°$, $y = 70°$

7. (a) 6 units
   (b) 3 : 5

8. (a) Δ APC and Δ AQE
   Δ ABP and Δ ADQ
   Δ ABC and Δ ADE

   (b) $x = 11\frac{2}{3}$ cm, $y = 7\frac{1}{2}$ cm, $z = 4\frac{2}{3}$

9. $x = 11\frac{3}{7}$ cm, $y = 14\frac{2}{7}$

10. $x = 15$ cm, $y = 10$ cm

11. $x = 3.6$ units, $y = 2$ units

12. (a) 12.8 cm (b) 10 cm

13. (a) 21 m (b) 136 cm^2 (c) 300 m^2

14. 16 cm^2, 2.175 km

15. (a) 43↓ cm (b) 150 cm^2

16. (a) 12 km (b) 5.12 km^2

17. (a) 63 m (b) 22 cm (c) 200 cm^2

18. (a) 8 cm (b) 24 cm^2

19. (a) 224 m (b) 15 cm (c) 15 cm^2

20. (a) 1 : 4 000 (b) 320 m (c) 9 200 m^2

21. (a) $\triangle$ ROS
(b) $\triangle$ QOP
(c) $\triangle$ RQS

22. $\angle$ QBR, $\angle$ACB, PR

23. (a) 90º (b) 7 cm

24. (a) 38 (b) 15

25. $x = 8$, $y = 82$, $z = 38$

26. (a) ΔABC and ΔADF
(b) ΔABC and ΔBDE

27. (a) $x = 98^0$, $y = 120^0$ (b) BC = 5 cm, CD = 8 cm

28. ΔABP and ΔEDP, ΔPBC, ΔPDC and ΔPEC

9. $x = 39$, $y = 3.7$

30. (a) 70º, 70º (b) 27 cm^2

31. $x = 112^0$, $y = 40^0$, $z = 8$

32. (a) $\angle$ACB (b) 10.5 cm

33. 12.6 cm

34. Ans: 2.7 m

35. (a) ΔAPQ and ΔBPQ, ΔABD and ΔCDB

(b) ΔDRQ and ΔDAB, ΔBCD and ΔDRQ

(c) 4 cm, 10 cm

36. (b) 13.5 cm, 9 cm

37. 10 cm, 10.5 cm

38. (a) ΔABC and ΔADF, ΔABC and ΔDBE
(b) ΔDBE and ΔDAF, ΔDEX and ΔCBX

39. (a) 7.5 cm
(b) 12.6 cm

40. (a) $5\frac{1}{4}$ cm
(b) 18 cm

41. (a) $\angle ABD = \angle BCD$, $\angle ABD = \angle CBD$
(b) 10 cm, 13 cm

42.
(a) ΔDXE and ΔBXA

(b) $3\frac{3}{4}$ cm, $4\frac{1}{2}$ cm

43. (a) ΔABC and ΔCQS, ΔBKC and ΔRKQ
(b) $9\frac{3}{4}$

44. (a) $4\frac{16}{45}$ cm

(b) $3\frac{7}{15}$ cm

45. (a) 7 cm
(b) $\frac{4}{9}$

46. (a) 60° , 73°
(b) $1\frac{31}{45}$ cm

47. (a) 8 cm
(b) 10 cm

48. (a) ΔBDC and ΔADB
(b) (i) $28\frac{4}{5}$ cm (ii) 31± cm

49. 1 : 125 000

50. 1 : 800

51. 405 km

52. 28 cm

53. 1 : 30 000, 1 cm^2

54. $\frac{1}{125\ 000}$, 8 cm^2

55. 400 ha

56. 12.5 cm^2

57. 250 000

58. (a) 50 cm (b) 15 km (c) 50 km^2

59. (a) 2.25 km (b) 0.9 cm^2

60. (a) 22.5 km (b) 1 : 225 000 (c) 2025 ha 374.

61. (a) 3 cm (b) 50 m^2

62. (a) 1: 80 000 (b) 9.2 km (c) 3.2 km^2

63. (a) 32 cm^2 (b) 2 cm^2

64. (a) 4.3 km (b) 600 ha

65. (a) 81 ha (b) 2 38/45cm^2

66. (a) 30.8 km (b) 64 km^2

67. (a) 13.2 km (b) 16 m^2

68. 17 500

69. 160 cm^2

Chapter 2

Secondary 2 Mathematics
Chapter 2 Direct and Inverse Proportion

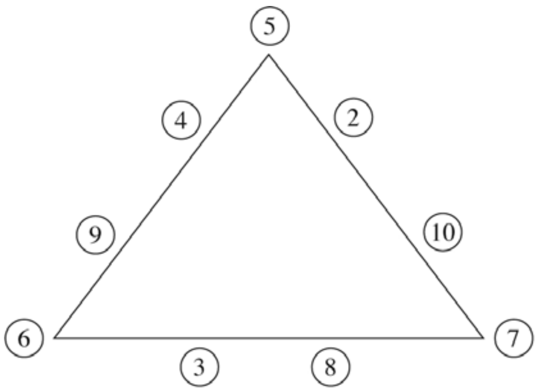
ANSWERS FOR ENRICHMENT ACTIVITIES

Just For Fun (pg 58)

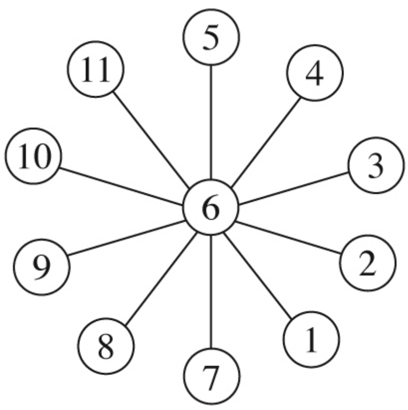
In each case, the toy train takes 1 second to cover the distance which is equal to the length of the train. Also, in each case, the train and the bridge are of equal length. Thus, in each case, the train will take 2 seconds to travel a distance which is the total length of the train and the bridge, to pass the bridge.

Just For Fun (pg 66)

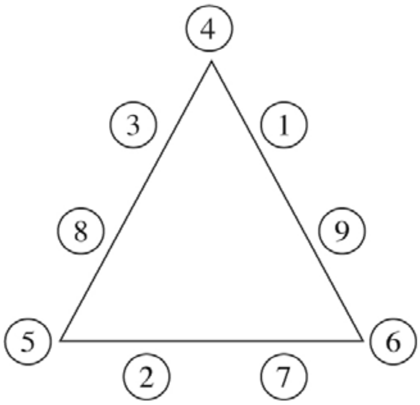
1.



2.



3.



Secondary 2 Mathematics
Chapter 2 Direct and Inverse Proportion

GENERAL NOTES

In this chapter, we are concerned with an algebraic tool which helps us to study relations between two or more quantities which are connected.

In Book 1, we looked at two simple relations between two quantities arithmetically in the form of direct and inverse proportions. In solving problems involving proportions, we relied on equivalent ratios. In this chapter, we see that problems can be solved by expressing the relation between two quantities in the form of an algebraic equation. In Book 2, we also considered the graphical representations of simple relations between two quantities in the form of graphs.

Teachers who are teaching a class of students studying physics can ask students to provide examples of practical work they had done to determine relations between two quantities in the form of algebraic equations by plotting graphs of experimental results.

Teachers may point out to their students that the various formulas for calculating areas of simple plane figures and surface areas and volumes of simple solids which they learnt in Book 1 and Book 2 are examples of algebraic equations connecting two or more quantities. Formulas like

$A = \frac{1}{2} \times b \times h$ (area of triangle with base b and height h)

$V = \frac{1}{3}\pi r^2 h$ (volume of a cone with base radius r and height h)

each of which involves three quantities, can be reviewed as relations between two quantities by keeping one of the three quantities constant.

For example, we may be interested in different volumes of cones having the same height but corresponding to different base radii. In this case, we consider that the volume V varies directly as the square of the radius r and the constant of variation is $k = \frac{1}{3}\pi h$.

XYZ SECONDARY SCHOOL

Name: ________________ (   )   Date: ____________

Time allowed: min

Class: _______   Marks: $\frac{}{8}$

Secondary 2 Multiple-Choice Questions
Chapter 2 Direct and Inverse Proportion

1. It is given that the force exerted between two bodies is inversely proportional to the square of the distance between them. If the force is F newtons when the distance between the bodies is d metres and KF newtons when the distance is $4d$ metres, find K.
   (A) $\frac{1}{16}$ (B) $\frac{1}{4}$ (C) 4 (D) 16 (E) $\frac{1}{2}$ ( )

2. If x is directly proportional to y, and x is inversely proportional to z, then $\frac{y}{z}$ is directly proportional to
   (A) x (B) $2x$ (C) $x + 2$ (D) $\sqrt{x}$ (E) x^2 ( )

3. If x is inversely proportional to y^2, which of the following is/are true?
   (I) $xy^2 = 1$ (II) $xy = \frac{k}{y}$, k is a constant (III) $y^2 \propto \frac{1}{x}$ (IV) xy^2 = constant
   (A) I only (B) I and II (C) II and III
   (D) III and IV (E) II, III and IV ( )

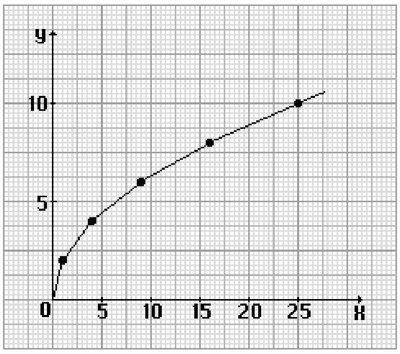
4. If p is directly proportional to r, and q is also directly proportional to r, which of the following is not correct?
   (A) p is directly proportional to q (B) pq is directly proportional to r
   (C) $(p + q)$ is directly proportional to r (D) $(p^2 - q^2)$ is directly proportional to r^2
   (E) $(ap + bq)$ is directly proportional to r, where a and b are constants
   ( )

5. $(s - 3)$ is inversely proportional to $(t + 3)$. Given that $t = 3$ when $s = 0$, find the value of s when $t = 0$.
   (A) 4 (B) 2 (C) 1 (D) -2 (E) -4 ( )

6. If A^2 is directly proportional to B^3, and B is inversely proportional to C^2, then the relationship between A and C is

(A) A^3 is directly proportional to $\frac{1}{C^2}$
(B) A^5 is directly proportional to $\frac{1}{C^6}$
(C) A^2C^6 = constant
(D) A is directly proportional to $\frac{1}{C^3}$
(E) A^6 is directly proportional to $\frac{1}{C}$ ( )

7. The graph shows the relation



(A) y is directly proportional to x
(B) y is directly proportional to x^2
(C) y is directly proportional to $\sqrt{x}$
(D) y is inversely proportional to $\sqrt{x}$
(E) y is inversely proportional to x^2

( )

8.

h	2	3	4	5	6	7	8
A	16	36	64	100	144	196	256

In an experiment to determine the relation between the area of the metal sheet used, A m^2, and height of the container, h m, made from the metal sheet, the results are shown in the table above. The relation between h and A is

(A) h is directly proportional to A
(B) h^2 is directly proportional to A
(C) A^2 is directly proportional to h
(D) h^2 is inversely proportional to A
(E) A^2 is inversely proportional to h ( )

Answers

1. A	2. E	3. E	4. B
5. D	6. C	7. C	8. B

XYZ SECONDARY SCHOOL

Name: ________________ (   )   Date: ____________

Time allowed: min

Class: _______   Marks:

Secondary 2 Mathematics Test
Chapter 2 Direct and Inverse Proportion

1. If q is inversely proportional to p, and $q = 120$ when $p = 2$, form an equation connecting p and q and calculate q when $p = 5$. [3]

2. If y is inversely proportional to $(2x + 1)$ and $y = 5$ when $x = 3$, find
(a) y when $x = 17$,   (b) x when $y = 7$. [2]

3. If y is inversely proportional to the square of $(3x + 2)$ and $y = 4$ when $x = \frac{2}{3}$, find
(a) y when $x = 11\frac{1}{3}$, (b) x when $y = 16$. [2]

4. Given that p is directly proportional to $\sqrt{2q + 1}$ and $p = 63$ when $q = 24$, find
(a) p when $q = 12$,   (b) q when $p = 27$. [2]

5. Given that d is directly proportional to the square root of t, copy and complete the table below. [3]

t	4	9		$2\frac{1}{4}$
d	8		20	

6. Two quantities P and Q are related by the formula $P = A - \frac{B}{Q^2}$, where A and B are constants. Given that $P = 1$ when $Q = 2$ and $P = 6$ when $Q = 3$,
(a) write down two equations in A and B,
(b) solve these equations to find the value of A and the value of B,
(c) find the positive value of Q when $P = 7\frac{3}{4}$. [6]

7. The intensity of illumination, I lumens/m^2, at a point on a screen is inversely proportional to the square of the distance, d m, of the light source from the point. Given that $d = 2.5$ m when
I = 0.8 lumens/m^2, find
(a) I, when $d = 1.25$ m,   (b) d, when $I = 0.05$ lumens/m^2. [3]

8. Water flows from a container such that the depth of water x cm at any instant, is inversely proportional to the square root of the time t s, for which the water has been flowing. After 25 s, the depth is 450 cm. Calculate the depth after

(a) 100 s, (b) 3 min 45 s. [3]

9. The resistance R, to the motion of a car is directly proportional to the speed v of the car. Given that the resistance is 2 688 newtons when the speed is 16 m/s, find

(a) the resistance when the speed is 28 m/s,

(b) the speed when the resistance is 16 800 newtons. [3]

10. The total cost, \$ c, of owning and operating a car is given by the formula $c = a + bx$, where x is the distance driven in km and a and b are constants. When the car is driven 2 500 km during it lifetime, the total cost is \$ 19 000 and when the car is driven 6 000 km during its lifetime, the total cost is \$ 20 400.

(a) Write down two equations in a and b.

(b) Solve these equations to find the value of a and of b.

(c) Find the total cost, if the car is driven a total distance of

(i) 50 000 km, (ii) 100 000 km. [6]

11. A local radio station has been given the exclusive rights to promote a concert in the city's civic arena, which seats 22 000 persons. The commission \$ C for the radio station is \$ 5 000 plus \$ 0.50 for each of the n tickets sold for the concert.

(a) Write down the formula connecting C and n.

(b) Use the formula to calculate

(i) the commission for the radio station when 15 000 tickets are sold,

(ii) the number of tickets sold when the commission for the radio station is \$ 11 250,

(iii) the maximum commission for the radio station. [4]

12. (a) If a is directly proportional to the cube of b and that $a = 54$ when $b = 3$, find the equation relating a and b. [2]

(b) Using the equation in (a), find the value of

(i) a when $b = 5$,

(ii) b when $a = 128$. [2]

13. In each of the following, find the unknown variable without finding the proportionality constant.

(a) If h is directly proportional to the square of k and $h = 8$ when $k = 3$, find h when $x = 6$. [2]

(b) If m is directly proportional to $\sqrt{n}$ and $m = 12$ when $n = 16$, find n when $m = 18$. [2]

14. If the height of a cylinder is fixed, its volume is directly proportional to the square of its radius. When the radius of the cylinder is 2 cm, its volume is 81 cm^3. Find the radius of the cylinder if the volume is 506.25cm^3. [3]

15. Given that a^2 is directly proportional to b^3 and $a = 8\sqrt{3}$ when $b = 4$,

(a) find the equation connecting a and b,

(b) find the value of a when $b = 3$. [3]

16. In each of the following, find the unknown variable.

(a) If is directly proportional to $\sqrt[3]{t}$ and $u = 10$ when $t = 8$, find u when $t = 125$.

(b) If z is directly proportional to the cube of s and $z = 64$ when $s = 8$, find z when $s = 6$. [4]

17. Given that y is inversely proportional to $\frac{1}{x+3}$, and that $y = 10$ when $x = 2$, express y in terms of x. [3]

18. If y is inversely proportional to x^2 and $y = 8$ when $x = 2$, find the value of y when $x = 4$. [3]

19. When a particle falls from rest in a vacuum, its distance from the starting point is directly proportional to the square of the time it has been falling. If a particle falls through 120 metres in 5 seconds, find

(a) how far it falls in 8 seconds,

(b) how long it takes to fall through 750 metres. [4]

20. Given that a is directly proportional to $\frac{1}{b^3}$ and $a = 4\frac{4}{9}$ when $b = 3$, find the value of a when $b = 8$. [3]

21. If $y - 2$ is directly proportional to x^2 and $y = 4$ when $x = 2$, find y when $x = 5$. [3]

22. If $y + 3$ is inversely proportional to $\sqrt{x}$ and $y = -2$ when $x = 4$, find y when $x = 9$. [3]

23. If $(y^2 - 1)$ is directly proportional to $(x + 2)$ and $y = 4$ when $x = 3$, find y when $x = 14$. [3]

24. Complete the following statements.

(a) If y is directly proportional to x^3, then x is ______________________________ ;
(b) If y is directly proportional to $\sqrt{x}$, then x is ______________________________ ;
(c) If $y = kx^2$, then x is ____ .[4]

25. Complete the following statements.

(a) If y is directly proportional to $x^{\frac{3}{2}}$, then x is _____________________ ;
(b) If y is inversely proportional to x^4, then x is _____________________. [3]

26. A solid sphere of radius 3 cm is of mass 9 kg. Find the mass of a sphere of the same material of radius 5 cm. [3]

27. The number of ball bearings that can be made from a given weight of metal is inversely proportional to the cube of the radius of the ball bearings. If 4 000 ball bearings of radius 2 mm can be made, find how many ball bearings of radius $1\frac{1}{4}$ mm can be made from an equal weight of metal. [3]

28. The safe speed for a train rounding a corner is directly proportional to the square root of the radius. If the safe speed for a curve of radius 64 m is 28 km/h, find the safe speed for a curve of radius 49 m. [3]

29. The volume (v ml) of a can of soft-drink is directly proportional to the square of the radius (r cm) of the circular base of the can. If a larger can of soft-drink is to be produced such that the volume increases by 125%, what is the percentage increase in the radius? [4]

30. The distance, in km, to the horizon is directly proportional to the square root of the height, in metres, of the observer from the ground. From a building 64 m above the ground, the furthest distance a person can see is 25.6 km.

(a) What is the farthest distance that a parachutist 576 m above the ground can see?
(b) What is a person's height above the ground if the farthest distance he can see is 4.48 km? [5]

31. If y is inversely proportional to x^2, how is y affected when
(a) x is doubled? **(b)** x is decreased by 75%? [4]

32. Given that y is inversely proportional to the square of x and that $y = a^2$ when $x = 1$; $y = a + 4$ when $x = 3$, find the values of a. [4]

33. Given that y is directly proportional to the square root of x and that $y = 1$ when $x = b^2$; $y = b + 3$ when $x = 16$, find the values of b. [4]

34. Given that y is inversely proportional to the cube root of x and that $y = c^2$ when $x = 8$; $y = c - \frac{1}{3}$ when $x = 27$, find the values of c. [4]

Answers

1. $q = \dfrac{240}{p}$, 48

2. (a) 1 (b) 2

3. (a) $1\frac{1}{3}$ (b) $-\frac{7}{12}$

4. (a) 45 (b) 4

5. 12, 25, 6

6. (a) $4A - B = 4$; $9A - B = 54$ (b) $A = 10$, $B = 36$ (c) 4

7. (a) 3.2 (b) 10

8. (a) 225 cm (b) 150 cm

9. (a) 4 704 newtons (b) 100 m/s

10. (a) $a + 2500b = 19\,000$; $a + 6000b = 14\,000$

(b) $a = 18\,000$, b = $\frac{2}{5}$ (c) (i) $ 38 000 (ii) 58 000

11. (a) $C = 5000 + 0.50n$

(b) (i) $ 12 500 (ii) 12 500 (iii) $ 16 000

12. (a) $a = 2b^3$ (b) (i) 250 (ii) 4

13. (a) 32 (b) 36

14. 5 cm

15. (a) $a^2 = 3b^3$ (b) ± 9

16. (a) 25 (b) 27

17. $y = 2(x + 3)$

18. 2

19. (a) 307.2 m (b) $12\frac{1}{2}$ seconds

20. $\frac{15}{64}$

21. $14\frac{1}{2}$

22. $-2\frac{1}{3}$

23. ± 7

24. (a) $\sqrt[3]{y}$ (b) y^2 (c) $\sqrt{y}$

25. (a) $y^{\frac{2}{3}}$ (b) $\frac{1}{\sqrt[4]{y}}$

26. $41\frac{2}{3}$ kg

27. 16 384

28. $24\frac{1}{2}$ km/h

29. 50 %

30. (a) 76.8 km (b) 1.96 m

31. (a) decreased by 75% (b) 16 times itself

32. –3 or 12

33. – 4 or 1

34. $\frac{1}{2}$ or 1

Chapter 3

Secondary 2 Mathematics
Chapter 3 Expansion and Factorisation of Algebraic Expressions

ANSWERS FOR ENRICHMENT ACTIVITIES

Just For Fun (pg 74)

If we let x be the age of the friend, then

2. $\rightarrow x+5$
3. $\rightarrow 2(x+5)$
4. $\rightarrow 2x+10+10$
5. $\rightarrow (2x+20)5$
6. $\rightarrow 10x+100-100=10x$

Cancel the last digit and we get x, the age of the friend.

Just For Fun (pg 100)

It is not possible to divide a number by 0. Thus, it is wrong to divide both sides by $(x - y)$ as we are told that $x = y$ in the beginning.

Just For Fun (pg 103)

From the table, the best design appears to be the design when $x = 16$m and $y = 12\frac{1}{4}$ m. You will notice that if the shape of the house is closer to that of a square, the less wall area it has and hence, less material is needed.

Just For Fun (pg 107)

Paul reached Marina Square at 7.40 p.m. while Julie turned up only at 8.20pm. Paul had to wait for 40 minutes.

Secondary 2 Mathematics
Chapter 3 Expansion and Factorisation of Algebraic Expressions

GENERAL NOTES

The expansion and factorisation of quadratic expressions are important topics so extra effort and time should be put into it. After teaching the various rules and methods of factorisation, it would be useful if students were taught how to recognise, identify and associate the various special kinds of factors.

The solving of quadratic equations by factorisation and the use of the rule that $A \times B = 0 \Rightarrow A = 0$ or $B = 0$ are some of the most important concepts in this chapter. The extension of this concept to more than two factors such as $A \times B \times C = 0 \Rightarrow A = 0$ or $B = 0$ or $C = 0$ can be emphasised also.

Common Errors Made By Students

The following are some examples.

1. $(2x+3y)^2 = 4x^2 + 9y^2$
2. $(3x+4y)^2 = 3x^2 + 4y^2$
3. $(3x-2y)^2 = 9x^2 - 4y^2$
4. $(5x-4y)^2 = 5x^2 - 4y^2$
5. $(2x+3y)(2x-3y) = 2x^2 - 3y^2$
6. $25x^2 - 1 = (25x+1)(25x-1)$
7. $x^2 + 3x + 2 = (x+2x)(x+x)$
8. $9x^2 + 4y^2 = (3x+2y)^2$
9. $4xy + 2xz = x(4y+2z)$ or $2(2xy+xz)$

XYZ SECONDARY SCHOOL

Name: ___________________ (   )　　　　Date: _____________

Class: ________　　　　Time allowed: 　min

Marks: $\frac{\quad}{11}$

Secondary 2 Multiple-Choice Questions
Chapter 3 Expansion and Factorisation of Algebraic Expressions

1. Factorise $16x^2 - 36y^2$ completely.
   (A) $(4x + 6y)(4x - 6y)$　(B) $4(2x + 3y)(2x - 3y)$　(C) $4(4x+9y)(4x-9y)$
   (D) $4(2x-3y)(2x-3y)$　(E) $4(2x+3y)(2x+3y)$　(   )

2. Factorise $a(x-y)-b(y-x)$.
   (A) $(x-y)(a-b)$　(B) $(x-y)(a+b)$　(C) $(y-x)(a-b)$
   (D) No factors　(E) $(x+y)(a-b)$　(   )

3. Simplify $\frac{1}{3}(a^2-1)\times(\frac{3}{a+1})^2$.
   (A) $\frac{(a^2-1)}{a+1}$　(B) $\frac{a-1}{a+1}$　(C) $\frac{3(a-1)}{a+1}$
   (D) $\frac{3}{a-1}$　(E) None of the above.　(   )

4. Factorise $6xy - 9x^2 - y^2$.
   (A) $(3x-y)^2$　(B) $(-3x-y)^2$　(C) $(-3x+y)^2$
   (D) $-(3x+y)^2$　(E) $-(3x-y)^2$　(   )

5. Simplify $(2x+\frac{1}{x})^2-(2x-\frac{1}{x})^2$.
   (A) -8　(B) 0　(C) 8
   (D) $4(x^2+\frac{1}{x^2})$　(E) None of the above.　(   )

6. If $a + b = x$ and $ab = y$, express $(a-b)^2$ in terms of x and y.
   (A) x^2-y　(B) x^2-2y　(C) x^2-4y　(D) x^2+2y　(E) x^2-y^2　(   )

7. Simplify $\frac{x^2+2x-3}{x^2+8x+15}$.

(A) $\frac{x-1}{x+5}$ (B) $\frac{x+3}{x-3}$ (C) $\frac{x+1}{x+5}$

(D) $\frac{2x-3}{8x+15}$ (E) None of the above. ( )

8. Simplify $(-a-b)^2-(a+b)(a-b)$.

(A) $2b^2$ (B) $-2a^2$ (C) $2b^2+2ab$

(D) $2b^2-2ab$ (E) None of the above. ( )

9. Solve the equation $6x^2-36x=0$.

(A) $\frac{1}{6}$ or 6 (B) 0 or -6 (C) $-\frac{1}{6}$ or -6

(D) 0 or 6 (E) None of the above. ( )

10. Solve the equation $6x+1=(2x-3)^2+8-2x$.

(A) 1 or 4 (B) 1 or –4 (C) –1 or 3 (D) $\frac{1}{4}$ or 4 (E) 2 or -2

( )

11. A man is 3 times as old as his son. 8 years ago the product of their ages were 112. Find the sum of the ages of the man and his son.

(A) 36 (B) 44 (C) 48 (D) 52 (E) 56 ( )

Answers

1. B	2. B	3. C	4. E	5. C	6. C
7. A	8. C	9. D	10. A	11. C	

XYZ SECONDARY SCHOOL

Name: __________________ (   )   Date: _____________

Time allowed: min

Class: ________   Marks:

Secondary 2 Mathematics Test
Chapter 3 Expansion and Factorisation of Algebraic Expressions

1. Simplify each of the following:
   (a) $(4a^2 - b^2) \div (2a - b)$ [2]
   (b) $(6p^2 - 5pq - 4q^2) \div (2p + q)$ [2]

2. Expand and simplify $(2x - 3y)(x + 5y) - (x - y)^2$ [2]

3. Simplify each of the following:
   (a) $3a^2 - (a - 2)^2$ [2]
   (b) $5x(x - 4) - (3x - 2)(x + 1)$ [2]

4. Expand and simplify each of the following:
   (a) $x(x - 2) + 3x(x - 4)$ [2]
   (b) $(x + 2)(x^2 - 5x + 1) - x^2(x - 3)$ [2]

5. Expand and simplify
   (a) $(x - 5)(3x^2 + 4)$ [2]
   (b) $x(x + 2) - (x - 5)(2x + 7)$ [2]

6. Expand and simplify
   (a) $(x + 2y)^2$ [1]
   (b) $(2x + 3y)^2 - (x - y)^2$ [2]

7. Expand and simplify $5(2a - 3b) - 6(a + 4b)$ [2]

8. Simplify (a) $\dfrac{x^2 + 2x - 15}{2x^2 + 13x + 15}$ [2]
   (b) $\dfrac{x^2 - 9}{x^3 + 7x^2 + 12x}$ [2]

9. Simplify (a) $\dfrac{2a+b}{3m-n} \div \dfrac{2a^2+ab}{3mn}$ [2]

(b) $\dfrac{t^3+2t^2}{5t^2+15t+10}$ [2]

10. Factorise the following expressions completely:

(a) $4a^2b + 6ab^2$ [2]

(b) $\dfrac{4}{25}a^2b^2 - \dfrac{1}{9}$ [2]

11. Factorise $x^2 - y^2$ and hence calculate the exact value of $234\,987^2 - 234\,986^2$. [3]

12. Factorise each of the following:

(a) $2x^2 + 18x + 28$ [2]

(b) $2ax + 4ay + 5x + 10y$ [2]

13. Factorise completely

(a) $36x^2 - 49$ [1]

(b) $3x^2 + 11x - 20$ [2]

14. Simplify each of the following:

(a) $\dfrac{x^2-y^2}{x+y}$ [2]

(b) $\dfrac{x^2+6x+5}{x+1} - \dfrac{3x^2-7x+4}{x-1}$ [3]

15. Using factors, evaluate each of the following:

(a) $2\,056^2 - 56^2$ [2]

(b) $801^2 - 1\,602 + 1$ [2]

16.(a) Factorise completely $4a^2 + 20a - 2ab - 10b$. [2]

(b) Solve the equation $\dfrac{6}{x} - \dfrac{7}{2x+3} = 2$. [3]

17. Evaluate each of the following:

(a) $1\,893^2 - 1\,892^2$ [1]

(b) $1\,893^2 - 1\,893 \times 1\,883$ [1]

18. Simplify (a) $(2x-1)^2-(x+1)^2$ [2]

(b) $3(x+2)(x-5)-(x-1)^2$ [2]

19. Factorise the following completely:

(a) $4x^2-25y^2$ [1]

(b) $6a^2-23a+21$ [2]

(c) $10x^2-12ab-15ax+8bx$ [2]

20. Factorise each of the following completely:

(a) $(2m+n)^2-(m-n)^2$ [2]

(b) $(a-b)^2-4a+4b$ [2]

21. Factorise each of the following completely:

(a) $a^2-b^2-3a-3b$ [2]

(b) $2ax-4ay+3dx-6dy$ [2]

22. Factorise completely:

(a) $18x^2-24xy+8y^2$ [2]

(b) $12a^2-11a-36$ [2]

23. Factorise completely:

(a) $2a^2+8a-ab-4b$ [2]

(b) $1-16a^4$ [2]

24. Factorise the following:

(a) $(x-4)(x+1)+4a-ax$ [2]

(b) $2x^2+xy-14x-7y$ [2]

25. Factorise the following completely:

(a) $18x^2-32y^2$ [2]

(b) $500x^2-3\,000x+4\,000$ [2]

(c) $5ax-12by+4bx-15ay$ [2]

26. Simplify $\dfrac{2x^5}{x-4}\div\dfrac{5x^3}{x^2-16}$ [2]

27. Simplify the following:

(a) $\dfrac{x^2-9}{x^2-6x+9}\div\dfrac{5x+15}{3x-9}$ [2]

(b) $3-\dfrac{7x+1}{3x-4}-\dfrac{x^2-5x-24}{3x^2+5x-12}$ [3]

28. Factorise the following completely:

(a) $x^4 - 16$ [2]

(b) $6a^2 - 10a - 56$ [2]

29. Simplify

(a) $\dfrac{x^2 - 2x - 3}{4x^2 + 14x + 10}$ [2]

(b) $\dfrac{3}{(x-1)(x+2)} + \dfrac{1}{x^2 + 5x + 6} - \dfrac{2}{(x-1)(x+3)}$ [3]

30. Factorise completely $(2x + 1)^2 - 6x - 3$. [2]

31. Factorise $2x^2 + 5x + 3$.
Hence or otherwise, write down the factors of 253. [3]

32. Factorise $a^2 - b^2$. Hence evaluate 201×199. [3]

33. Factorise $2x^2 + 20x + 42$ completely. Hence or otherwise, express 442 as the product of three prime numbers. [4]

34. Find the exact value of $1999^2 - 1998^2 + 1997^2 - 1996^2$ without using a calculator. [4]

35. Given that $x^2 + y^2 = 48$ and $x\,y = 5.5$, find the value of $(2x - 2y)^2$. [4]

36. Solve the equation $x(x + 7) - 6(x + 5) = 0$. [2]

37. Solve the equation $5x^2 - 12x = 0$. [2]

38. Solve the following equations

(a) $2 - 5x - 12x^2 = 0$ [2]

(b) $3x^2 - 48 = 0$ [2]

39. Solve the following equations:

(a) $x^2 - x = 2$ [2]

(b) $2x^4 + x^3 + 16x + 8 = 0$ [3]

40. Solve the following equations:

(a) $(2x - 3)(5 - 3x) = 0$ [2]

(b) $6x^2 - 7x = 0$ [2]

41. Solve the equation $(x-4)^2 = 2x-5$. [3]

42. Solve the following equations:

(a) $\frac{3}{x} = x+2$ [2]

(b) $4x^2 - 16 = 0$ [2]

43. Find the value of k such that $3x^2 + 2k = 3(x-2)^2 + 12x$. [2]

44. Given that $21.35^2 - 7.65^2 = 29k$, find the value of k. [2]

45. Solve the following equations:

(a) $x(3x + 4) = 4$ [2]

(b) $2x^2 + 3x = 14$ [2]

46. Solve the following equations

(a) $2x^2 - 7x - 15 = 0$ [2]

(b) $21x^2 - 4 = 8x$ [2]

47. Solve the following equations:

(a) $\frac{3}{x-2} + \frac{5}{x-3}$ [2]

(b) $(x+2)^2 = (x-1)^2$ [2]

48. Solve the equations:

(a) $6x^2 - 28x + 30 = 0$ [2]

(b) $5 - 20x^2 = 0$ [2]

49. Solve the equation 6/x -7/ (2x +3) = 2 [3]

50. Solve the equation (x+2) (2x – 9) = 24 [3]

51. Solve the equations:

(a) $(x + 3)^2 = 49$ [2]

(b) 6/x = 1 + 5/ (x + 2) [3]

52. Solve the equations:

(a) (x + 3) (x-4) - 8 = 0 [2]

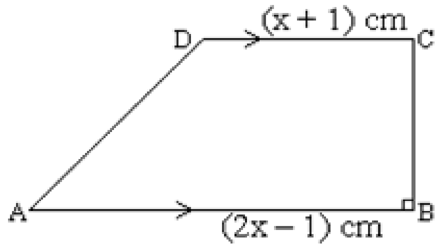
(b) $(2x - 3)^2 - 36 = 0$ [2]

53. Sam is 8 years older than his sister. If the product of their ages is 105, how old is Sam? [4]

54. The length and breadth of a rectangle are $(2x + 3)$cm and $(x + 4)$ cm respectively. If the area of the rectangle is 88 cm^2, find
(a) the value of x, [3]
(b) the perimeter of the rectangle. [3]

55. A car travels 600 km at an average speed of x km/h. If the car travels at a speed of $(x – 5)$km/h, the journey would have taken 30 minutes longer. Form an equation and show that it reduces to $x^2 – 5x = 6\ 000$. Solve this equation and find the time taken when the car travels at a speed of x km/h. [7]

56. *ABCD* is a trapezium in which *AB* is parallel to *DC* and *ABC*=90 .
(a) Given that $AB = (2x – 1)$cm, $DC = (x + 1)$cm, $BC = (x – 2)$cm and that the area of the trapezium is 36 cm , form an equation in x and show that it reduces to. [3]
(b) Solve the equation and hence find the length of *AB*. [3]



57. The sum of two numbers is 12 and their product is 35. Find the two numbers. [3]

58. The difference between two positive integers is 5 and the difference between their reciprocals is $\frac{5}{24}$. Find the integers. [4]

59. The length of a rectangular lawn is 15 metres more than its breadth. If its area is 5 200 m^2 , find the perimeter of the lawn. [4]

60. A motorist travels for $(2x – 3)$ hours at an average speed of $(9x + 14)$ km/h. Given that the total distance traveled is 250 km, form an equation in x and show that it reduces to $18x^2 + x – 292 = 0$. Solve the equation and hence find the average speed of the motorist. [7]

61. The lengths of a right-angled triangle are $(7 – x)$cm, $(5x + 2)$ cm and $(5x + 3)$cm. Write down in terms of x,
(a) the perimeter, [1]
(b) the area of the triangle. [2]
Form an equation in x and hence solve for x in order to find the perimeter and area of the triangle. [4]

62. Solve the following equations:

(a) $x^2 - 3x - 28 = 0$
(b) $15 - 2x - x^2 = 0$
(c) $12 + 19x + 4x^2 = 0$
(d) $x(x + 2) = 8$
(e) $3x^2 + 3 = 10x$
(f) $(5x - 2)^2 - 9x^2 = 0$
(g) $(5b - 4)^2 - 4b^2 = 0$
(h) $3 + 8h + 4h^2 = 0$
(i) $3x^2 - 5x = 2$
(j) $6x^2 - 7x = 20$
(k) $2x^2 + 4x = 30$
(l) $3x^4 - 243 = 0$ [12]

63. Find two positive whole numbers that differ by 6 and whose product is 91. [2]

64.Find two positive whole numbers such that they differ by 7 and the sum of their squares is 169. [2]

65.Find two consecutive positive even numbers such that the square of their sum is 100. [2]

66.When the product of 2 and a number is subtracted from three times the square of the number, the result is 3. Find the possible values of the number. [3]

67. The sides of a rectangle are of lengths 2x m and (3x–1) m. if the area of the rectangle is 88 m^2, find the perimeter of the rectangle. [3]

68. Expand each of the following expressions:

(a) $(3x + 7y)^2$
(b) $(1 - 4y)^2$
(c) $(4a - 3b)^2$
(d) $(2x - 5y)(2x + 5y)$
(e) $(3a - 2b)(a + 7b)$
(f) $(4a - 9b)(3a - b)$
(g) $(2x - 5y)(7x + 9y)$
(h) $(x - 3y)(2x^2 + y)$
(i) $(x + 5y)(x^2 - 4y)$
(j) $(x - 3)(x^2 - 3x + 4)$ [10]

69.Expand and simplify each of the following expressions:

(a) $(x + y)^2 + (x - y)^2$
(b) $(3x + y)^2 - (x - 2y)^2$
(c) $(c + 2d)^2 - 2(c + d)^2$
(d) $(x - y)^2 - (x + y)(x - 5y)$
(e) $(x - 3)^2 + (x - 4)(x - 7)$
(f) $3x(x - 2) - (x - 5)^2$
(g) $5(x - 4)^2 + 3(2x - 3)^2$
(h) $(x + 3)(x^2 - 4) - x(x - 5)^2$
(i) $x^2(x - 4) + x(2x + 3)^2$
(j) $5x(x - 1)^2 - 3x(x - 7)^2$ [10]

70.Factorise each of the following where possible:

(a) $4x^2y^3 + 16x^3y^4 - 8x^4y^5$
(b) $5x^2 - 15xy + 10$
(c) $72x^2 - 2y^2$
(d) $x^2 - 13x + 36$
(e) $x^2 - 4(y + 1)^2$
(f) $8(x - y)^2 - 50(2x + y)^2$
(g) $(5a - 3)^2 - 9b^2$
(h) $3a^2 - 48$
(i) $80 - 5x^4$
(j) $3xy - 6zy - xh + 2zh$
(k) $a^3 - a^2b - ab^2 + b^3$
(l) $a^2 - ab - ac + bc$
(m) $5h + 1 - 2k - 10hk$
(n) $2am - an - 8bm + 4bn$ [14]

71. Show that the sum of the squares of any three consecutive even numbers is divisible by 4. [2]

72. Show that the sum of the squares of any four consecutive odd numbers is divisible by 4. [2]

Answers

1.Ans: (a) $2a + b$ (b) $3p - 4q$

2.Ans: $x^2 + 9xy - 16y^2$

3.Ans: (a) $2a^2 + 4a - 4$ (b) $2x^2 - 21x + 2$

4.Ans: (a) $4x^2 - 14x$ (b) $2 - 9x$

5. Ans: (a) $3x^3 - 15x^2 + 4x - 20$ (b) $-x^2 + 5x + 35$

6.Ans: (a) $x^2 + 4xy + 4y^2$ (b) $3x^2 + 14xy + 8y$

7.Ans: $4a - 39b$

8.Ans: (a) $\frac{x - 3}{2x + 3}$

(b) $\frac{x - 3}{x(x+4)}$

9.Ans: (a) $\frac{n}{a}$

(b) $\frac{t^2}{5(t + 1)}$

10. Ans: (a) $2ab(2a + 3b)$

(b) $(\frac{2}{5}ab + \frac{1}{3})(\frac{2}{5}ab - \frac{1}{3})$

11. Ans: $(x + y)(x - y)$; 469 973

12.Ans: (a) $2(x + 2)(x + 7)$ (b) $(x + 2y)(2a + 5)$

13.Ans: (a) $(6x + 7)(6x - 7)$ (b) $(3x - 4)(x + 5)$

14.Ans: (a) $x - y$ (b) $9 - 2x$

15.Ans: (a) 4 224 000 (b) 640 000

16. Ans: $2(2a - b)(a + 5)$

17.Ans: (a) 3 785 (b) 18 930

18.Ans: (a) $3x^2 - 6x$ (b) $2x^2 - 7x - 31$

19.Ans: (a) $(2x + 5y)(2x - 5y)$ (b) $(2a - 3)(3a - 7)$ (c) $(2x-3a)(5x + 4b)$

20.Ans: (a) $3m(m + 2n)$ (b) $(a – b)(a – b – 4)$

21.Ans: (a) $(a + b)(a – b – 3)$ (b) $(x – 2y)(2a + 3d)$

22.Ans: (a) $2(3x + 2y)^2$ (b) $(3a + 4)(4a – 9)$

23.Ans: (a) $(a + 4)(2a – b)$ (b) $(1 + 4a^2)(1 + 2a)(1 – 2a)$

24.Ans: (a) $(x – 4)(x – 1 – a)$ (b) $(2x + y)(x – 7)$

25.Ans: (a) $2(3x + 4y)(3x – 4y)$ (b) $500(x – 2)(x – 4)$ (c) $(x – 3y)(5a + 4b)$

26.Ans: $\frac{2}{5}x^2(x + 4)$

27.
Ans: (a) $\frac{3}{5}$

(b) $\frac{x - 5}{3x - 4}$

28.Ans: (a) $(x^2 + 4)(x + 2)(x – 2)$ (b) $2(3a + 7)(a – 4)$

29.
Ans: (a) $\frac{x - 3}{2(2x + 5)}$

(b) $\frac{2}{(x - 1)(x + 3)}$

30. Ans: $2(2x + 1)(x – 1)$

31.
Ans: $(2x + 3)(x + 1)$; 11, 23

32.
Ans: $(a + b)(a – b)$; 39 999

33.
Ans: $2(x + 3)(x + 7)$; 2 x 13 x 17

34.Ans: 7990

35.Ans: 148

36.Ans: 5 or – 6

37.Ans: 0, 2/5

38.Ans: (a) ¼ or – 2/3 (b) 4 or –4

39.Ans: (a) 2 or –1 (b) –2 or – ½

40.
Ans: (a) 1 ½ or 1 2/3
(b) 0 or 1 1/6

41. Ans: 3 or 7

42. Ans: (a) 1 or –3 (b) 2 or –2

43. Ans: $k = 6$

44.Ans: 13.7

45.Ans: (a) 2/3 or – 2 (b) 2 or – 3 ½

46.Ans: (a) 5 or – 1 ½ (b) 2/3 or –2/7

47.Ans: (a) 2 3/8 (b) – ½

48.Ans: (a) 3 or 1 2/3 (b) ½ or - ½

49. Ans: 2 or - 2 ¼

50.Ans: 6 or – 3 ½

51. Ans: (a) 4 or – 10 (b) – 1 or –9

52.Ans: (a) 5, – 4 (b) 4 ½ or – 1 ½

53.Ans: 15 years

54.Ans: (a) 4 (b) 38

55.Ans: *x*, = 80, 7.5 hours

56.Ans: *x*, = 6, 11cm

57. Ans: 5, 7

58. Ans: 3, 8

59. Ans: 290m

60. Ans: *x*, = 4; 50 km/h

61.

Ans: (a) $(9x + 12)$cm

(b) $x^2 - 24x - 44 = 0$. The possible values of x are 2 cm or 22 cm.

62. Ans: (a) -4 or 7 (b) -5 or 3 (c) $-\frac{3}{4}$ or 4

(d) -4 or 2 (e) $\frac{1}{3}$ or 3 (f) 1 or $\frac{1}{4}$

(g) $1\frac{1}{3}$ or $\frac{4}{7}$ (h) $-1\frac{1}{2}$ or $-\frac{1}{2}$ (i) $-\frac{1}{3}$ or 2

(j) $2\frac{1}{2}$ or $-1\frac{1}{3}$ (k) -5 or 3 (l) 3 or -3

63. Ans: 7, 13

64. Ans: 5, 12

65. Ans: 4, 6

66. Ans: -3, $3\frac{2}{3}$

67. Ans: 38m

68. Ans:

(a) $9x^2 + 42xy + 49y^2$ (b) $1 - 8y + 16y^2$ (c) $16a^2 - 24ab + 9b^2$

(d) $4x^2 - 25y^2$ (e) $3a^2 + 19ab - 14b^2$ (f) $12a^2 - 31ab + 9b^2$

(g) $14x^2 - 17xy - 45y^2$ (h) $2x^3 + xy - 6x^2y - 3y^2$ (i) $x^3 - 4xy + 5x^2y - 20y^2$

(j) $x^3 - 6x^2 + 13x - 12$

69. Ans:

(a) $2x^2 + 2y^2$ (b) $8x^2 + 10xy - 3y^2$ (c) $2d^2 - c^2$

(d) $2xy + 6y^2$ (e) $2x^2 - 17x + 37$ (f) $2x^2 + 4x - 25$

(g) $17x^2 - 76x + 107$ (h) $13x^2 - 29x - 12$ (i) $5x^3 + 8x^2 + 9x$

(j) $2x^3 + 32x^2 - 142x$

70. Ans:

(a) $4x^2y^3(1 + 4xy - 2x^2y^2)$ (b) $5(x^2 - 3xy + 2)$ (c) $2(6x + y)(6x - y)$

(d) $(x - 9)(x - 4)$ (e) $(x + 2y + 2)(x - 2y - 2)$ (f) $-6(4x + y)(8x + 7y)$

(g) $(5a - 3 + 3b)(5a - 3 - 3b)$ (h) $3(a + 4)(a - 4)$ (i) $5(4 + x^2)(2 + x)(2 - x)$

(j) $(x - 2z)(3y - h)$ (k) $(a - b)^2(a + b)$ (l) $(a - b)(a + c)$

(m) $(1 - 2k)(1 + 5h)$ (n) $(a - 4b)(2m - n)$

Chapter 4

Secondary 2 Mathematics
Chapter 4 Algebraic Manipulation and Formulae

ANSWERS FOR ENRICHMENT ACTIVITIES

Just For Fun (pg 121)
128 balloons and 8 guests

Just For Fun (pg 127)
6, 7, 8 and 9.
Assume their ages to be x, (x + 1), (x + 2) and (x + 3) respectively. Since the product is less that 10 000, the ages of each of the four children cannot exceed 10 and since the last digit of 3 024 is not 0, none of the children should be 10 years or 5 years old. This quickly leads to the ages of 6, 7, 8 and 9.

Just For Fun (pg 128)
Try to play a few games to find the answer.

Just For Fun (pg 133)
Let x represents the number for the month and y represents the number for the day you were born. For example, if you were born on 12th September, then x will be 9 and y will be 12.
(1) $5x$
(2) $5x + 7$
(3) $4(5x + 7) = 20x + 28$
(4) $20x + 28 + 13 = 20x + 41$
(5) $5(20x + 41) = 100x + 205$
(6) $100x + 205 + y$
(7) $100x + 205 + y - 205 = 100x + y$

Thus the answer will be a 3–digit number if you were born in the months of January through September and it will be a 4–digit number if you were born in October, November or December.

Just For Fun (pg 138)

1. $\begin{array}{r} 21978 \\ \times \quad 4 \\ \hline 87912 \end{array}$

2. $\dfrac{9867}{3289} = 3$

Just For Fun (pg 139)

(a) $\begin{array}{r} 9\,567 \\ +\ 1085 \\ \hline 10\,652 \end{array}$

(b) $\begin{array}{r} 9672 \\ +1062 \\ \hline 10824 \end{array}$, $\begin{array}{r} 9274 \\ +1074 \\ \hline 10348 \end{array}$, $\begin{array}{r} 9287 \\ +1087 \\ \hline 10374 \end{array}$

Just For Fun (pg 143)

1. $\frac{1}{2}+\frac{1}{3}+\frac{1}{6}=1 \;\therefore$ x=2, y=3, z=6

2.
   1. $(1+2)\div 3=1$
   2. $(12\div 3)\div 4=1$
   3. $[((1+2)\div 3)+4]\div 5=1$
   4. $[(12\div(3\times 4)+5]\div 6=1$
   5. $[1-2+3+4-5+6]\div 7=1$
   6. $12\div(3\times 4)+5-6-7+8=1$
   7. $[1-2+3+4-5+6]\div 7\times(-8+9)=1$

There are other alternatives

Just For Fun (pg 143)

$15\times 15=225$

Secondary 2 Mathematics
Chapter 4 Algebraic Manipulation and Formulae

GENERAL NOTES

Most pupils find the topic on changing the subject of the formula difficult. However this topic is very important. Teachers should give more time to help pupils grasp the topic.

Students frequently use wrong or partial operations when dealing with this topic. Teachers could start with the elementary process in dealing with an equation i.e.

(i) a term may be added to or subtracted from both sides of an equation.
(ii) both sides of an equation may be multiplied or divided by equal numbers or terms.

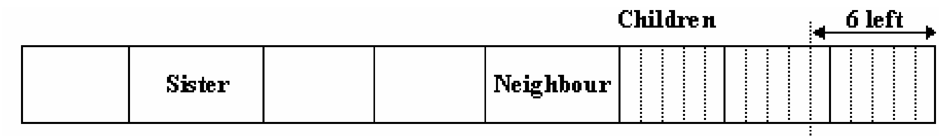
After the students have grasped the concept and discovered for themselves that the processes detailed in (i) and (ii) can be simplified, teachers can then introduce the short–cut method of transferring a term from the left side of a formula or equation to the right side by changing the sign from + to – and vice versa

Common Errors Made By Students

When it comes to × or ÷, common errors frequently occur when students multiply or divide partially. For example,

1. $3x = 6xz + 7xy$ is taken to imply $x = 2xz + 7xy$
2. $\frac{1}{3}x = 4y + z$ is taken to imply $x = 12y + z$

Teachers can remind their students that if x is to be made the subject of a formula, only x should appear on one side of the formula. Teachers may also wish to use the model method to illustrate the solution to Example 14 on page 132-134 which may be a comfortable way of solving sums for some students.



Divide the bar into 8 equal parts, 4 parts (i.e. $\frac{1}{2}$) for sister, 1 part ($\frac{1}{4}$ of the remaining 4 parts) for the neighbour. Divide the 3 parts into 15 smaller parts; $\frac{3}{5}$ of the 15 smaller parts are given to children, leaving 6 smaller parts which represent 6 oranges. Hence, 1 big part represents 5 oranges and this leads to the conclusion that Mrs Li bought a total of 40 oranges.

XYZ SECONDARY SCHOOL

Name: ________________ (   )　　　　　Date: ____________

Time allowed: min

Class: _______　　　　　Marks: $\frac{}{9}$

Secondary 2 Mathematics Test

Chapter 4　Algebraic Manipulation and Formulae

Multiple-Choice Questions

1. Simplify $\frac{5x+2y}{10xy}$.

   (A) 1　(B) $\frac{x+2y}{y}$　(C) $\frac{x+y}{xy}$　(D) $\frac{1+2y}{2y}$

   (E) None of the above.　(   )

2. Simplify $\frac{4x+y}{4xy}$.

   (A) x + y　(B) $\frac{1+y}{y}$　(C) $\frac{x+1}{x}$　(D) $\frac{1+x}{y}$

   (E) None of the above.　(   )

3. If $a \neq 0$, simplify $\frac{1}{a}+\frac{1}{2a}+\frac{1}{3a}$.

   (A) $\frac{1}{2a}$　(B) $\frac{1}{6a}$　(C) $\frac{5}{6a}$　(D) $\frac{5}{6a^3}$

   (E) $\frac{11}{6a}$　(   )

4. A pool can be filled by a large pipe alone in x hours or by a smaller pipe alone in y hours. If the pool is filled by both pipes simultaneously, find the total number of hours taken.

   (A) $\sqrt{xy}$　(B) $\frac{1}{2}(x+y)$　(C) $\frac{xy}{x+y}$　(D) $\frac{x^2}{x+y}$

   (E) None of the above.　(   )

5. If $x=\frac{a+b}{2}$ and $y=\frac{a-b}{2}$, express x^2-y^2 in terms of a and b.

   (A) $\frac{ab}{2}$　(B) ab　(C) 2ab　(D) $\frac{ab}{4}$

   (E) None of the above.　(   )

6. A lorry is x metres in front of a car. The car and the lorry are moving in the same direction at speeds of v m/s and u m/s respectively where v > u. How many seconds will it take the car to catch up with the lorry?

(A) $\frac{x}{u}-\frac{x}{v}$ (B) $\frac{x}{v}-\frac{x}{u}$ (C) $\frac{x}{v-u}$ (D) $\frac{x}{u+v}$

(E) None of the above. ( )

7. If $\frac{1}{a}+\frac{1}{b}=\frac{1}{c}$, express b in terms of a and c.

(A) $\frac{ac}{a-c}$ (B) $\frac{ac}{c-a}$ (C) $\frac{a-c}{ac}$ (D) $\frac{1}{c-a}$

(E) None of the above. ( )

8. If $p=\frac{x+q}{x-r}$, express x in terms of p, q and r.

(A) $\frac{q+pr}{1+p}$ (B) $\frac{q+pr}{p-1}$ (C) $\frac{q-pr}{1+p}$ (D) $\frac{q-pr}{p-1}$

(E) None of the above. ( )

9. If $t=2\sqrt{\frac{u}{v}}$, then u=

(A) $\frac{v^2 t}{4}$ (B) $\frac{t}{4v^2}$ (C) $\frac{t^2 v}{2}$ (D) $\frac{t^2 v}{4}$

(E) $\frac{t\sqrt{v}}{2}$ ( )

Answers

1. E	2. E	3. E	4. C	5. B
6. C	7. A	8. B	9. D	

XYZ SECONDARY SCHOOL

Name: __________________ (   )

Class: ________

Date: _____________

Time allowed: min

Marks:

Secondary 2 Mathematics Test

Chapter 4 Algebraic Manipulation and Formulae

1. Find the HCF and LCM of $12\,a^3b^4c^2$, $18\,a^2b^5c^3$ and $30\,a^4b^2c^5$. [2]

2. Simplify $\dfrac{\frac{x}{y}+\frac{1}{x}}{\frac{3x}{2y}}$. [3]

3. Simplify $\dfrac{2}{x+1}-\dfrac{3}{x-1}+\dfrac{4x}{1-x^2}$. [3]

4. Express $\dfrac{2x+3}{a}+\dfrac{x-3}{2a}$ as a single fraction in its simplest form. [2]

5. Simplify (a) $\dfrac{2}{3ab}-\dfrac{4}{5ac}+\dfrac{1}{6bc}$ [2]

(b) $3+\dfrac{a-3}{a}-\dfrac{b-4}{b}$ [2]

(c) $2-\dfrac{x}{2}+\dfrac{x-3}{4}$ [2]

6. Simplify the following expressions:

(a) $a+\dfrac{2a}{7}-\dfrac{a}{5}$ [2]

(b) $\dfrac{2x-3}{4}+\dfrac{x-2}{3}-\dfrac{7x-5}{6}$ [3]

7. Simplify (a) $\dfrac{x^2-1}{(3x-2)-(2x-3)}$ [2]

(b) $5-\dfrac{1}{x-1}+\dfrac{2}{x+1}$ [2]

8. (a) Express $\dfrac{5}{x-2}-\dfrac{4}{x-3}$ as a single fraction in its simplest form. [2]

(b) Simplify $\dfrac{x^2-4}{3x^2-21x+36}\div\dfrac{x-2}{3}$ [2]

9. Simplify the following expressions:

(a) $\dfrac{x}{4}-\dfrac{4(x-5)}{3}+\dfrac{x}{6}$ [2]

(b) $\dfrac{a+2}{5}-\dfrac{3(2a-3)}{6}+\dfrac{a-4}{15}$ [2]

10. Express $\dfrac{3t}{(t-1)(t-2)}-\dfrac{2}{t+2}$ as a fraction in its lowest terms. [3]

11. Given that $\dfrac{3x+2y}{(t-1)(t+2)}-\dfrac{2}{t+2}$, find the numerical value of $\dfrac{3x}{2y}$. [3]

12. Express the following as a single fraction in its lowest term:

(a) $3-\dfrac{a+4b}{a-b}$ [1]

(b) $\dfrac{x}{2}+\dfrac{x-y}{3}-\dfrac{3x-5y}{8}$ [2]

13. (a) Express $\dfrac{1}{x+5}+\dfrac{3}{2x-7}$ as a single fraction in its simplest form. [2]

(b) Solve the equation $\dfrac{2x-5}{7}=\dfrac{3x-7}{5}$. [2]

14. Given that $x = \dfrac{12+y}{4-y}$, solve the following:

(a) If $y = -2$, calculate the value of x, giving your answer as a fraction in its lowest terms. [1]
(b) Express y in terms of x . [2]

15. Express $\dfrac{5}{x+3} - \dfrac{1}{x-3} + \dfrac{7}{x^2-9}$ as a single fraction. [3]

16. If $\dfrac{2x-5y}{x-6y} = \dfrac{3}{4}$, find the value of $\dfrac{x}{y}$. [3]

17. Make y the subject of the formula $\dfrac{1}{x} + \dfrac{1}{\sqrt{y}} = \dfrac{1}{z}$. [3]

18. Given that $x = t^2 + 3$ and $y = t - 2$, express x in terms of y . [3]

19. Make b the subject of the formula $2a = \dfrac{b+4c}{3b}$. [3]

20. Simplify the following fraction $\dfrac{a^2-ab}{b^2-bc} + \dfrac{b^2-ab}{ab-ac}$. [3]

21. Given that $\dfrac{ax-5y}{5a-2x} = \dfrac{2}{3}$, express a in terms of x and y. [2]

22. Given that $p = \dfrac{q}{2q+r}$, find

(a) the value of p when $q = \dfrac{2}{3}$ and $r = \dfrac{7}{9}$, [1]
(b) the expression for r in terms of p and q. [2]

23. It is given that $a = \dfrac{2+b}{3-b}$, express b in terms of a. If a =7, find the value of b. [3]

24. Given that $3a^2 = \dfrac{x+y}{2-xy}$, express y in terms of a and x. [3]

25. Simplify $\frac{2a}{x-2y}+\frac{6}{2x-4y}+\frac{a-b}{3x-6y}$. [3]

26. If $v = u + at$,

(a) make a the subject of the formula, [2]

(b) find the value of a when $v = 32$, $u = 8$ and $t = 1\frac{1}{2}$. [1]

27. If $\frac{x-2y}{5x} = 2y - 8a$,

(a) make y the subject of the formula , [3]

(b) find the value of y when $x = 2$ and $a = 1$. [1]

28. Given that $x = \frac{y}{2-a}$, express a in terms of x and y. Find the value of a when $x = 1\frac{1}{2}$ and $y = 3\frac{3}{4}$. [3]

29. (a) Express $\frac{3}{x-1}-\frac{2}{x+3}$ as a single fraction in its simplest form. [3]

(b) Hence or otherwise, solve the equation $\frac{3}{x-1}-\frac{2}{x+3}=0$. [2]

30. Express $\frac{1}{x-2}-\frac{2}{x^2-4}$ as a single fraction in its simplest form. [3]

31. Express $\frac{7}{3x-y}-\frac{5}{y-3x}$ as a single fraction in its simplest form. [3]

32. Given that $\frac{1}{2a}=\frac{2}{3x}+\frac{4}{5b}$, express x in terms of a and b. Find the value of x when $a = 5$ and $b = 2$. [4]

33. Given that $2a=\frac{3}{b}-\frac{1}{c}$, express b in terms of a and c. Hence find the value of b when $a = 5$ and $c=\frac{1}{2}$. [4]

34. Given that $\frac{3y+2}{2y-2}=\frac{4x}{5}$, make y the subject of the formula. [3]

35. Given that $\frac{2}{x}-\frac{3}{y}=42$, express y in terms of x and z. [3]

36. Given that $p=\frac{4x+5}{x-3}$, express x in terms of p. [3]

37. Express $\frac{3}{5x-2}-\frac{7x}{25x^2-15x+2}$ as a single fraction. [3]

38. Express $\frac{5}{x+3}-\frac{2x-7}{3x+9}$ as a single fraction in its simplest form. [2]

39. If $\frac{5x+7y}{4x-3y}=\frac{2}{5}$, find the value of $\frac{3x}{y}$. [2]

40. Given that $\frac{ax-by}{3a-5y}=\frac{2}{3}$, express y in terms of a and x. [3]

41. Express $\frac{3}{x-1}+\frac{5}{x+1}-\frac{4}{x^2-1}$ as a single fraction in its simplest form. [2]

42. Make y the subject of the formula $\frac{3x}{4}=\frac{x-y}{4x+3y}$. [1]

43. Simplify (a) $\frac{2x^2-x-3}{24x^2}\div\frac{4x^2-9}{6x^2+9x}$ [2]

(b) $\frac{5}{x-y}-\frac{3}{y-x}$ [2]

44. Solve the following equation : $\frac{5}{x-3}-\frac{x+5}{(x-3)(x+2)}=\frac{7}{x+2}$. [3]

45. Solve the following equations:

(a) $\dfrac{2x-5}{3}-\dfrac{x-6}{5}=1$ [2]

(b) $\dfrac{x}{2}+\dfrac{x+1}{9}=x-3$ [2]

46. Solve the following equations:

(a) $\dfrac{6}{x}-2=\dfrac{3}{x+1}$ [2]

(b) $x-2=x(x+4)$ [2]

47. Solve the following equations:

(a) $\dfrac{x+1}{4}+\dfrac{3x+2}{3}=3\dfrac{1}{5}-\dfrac{x}{5}$ [3]

(b) $\dfrac{3x-4}{3}=1-\dfrac{x+5}{7}$ [3]

48. Solve the equation $\dfrac{5}{3x-1}-\dfrac{4}{1-3x}+\dfrac{7}{9x-3}=5$. [3]

49. When 12 is subtracted from $3\dfrac{1}{2}$ times of a number, the result is $1\dfrac{1}{4}$ times the original number. Find the number. [3]

50. What number must be added to both the numerator and denominator of the fraction $\dfrac{5}{9}$ to give it a result of $\dfrac{2}{3}$? [4]

51. A large pipe can fill a tank alone in 3 hours while a small pipe will take 6 hours to fill it alone. How long will it take for the two pipes to fill the tank together? [3]

52. Divide 48 into two parts so that the sum of $\dfrac{3}{8}$ of one part and $\dfrac{3}{4}$ of the other is equal to 24. [4]

53. The perimeter (P) of a sector of a circle of radius r cm and angle x is given by $p = 2r + \dfrac{\pi r x}{180}$.

(a) Express x in terms of p , π and r. [2]

(b) Express r in terms of p , π and x. [3]

(c) Find the value of r when $p = 19\frac{1}{2}$, $\pi = 3\frac{1}{7}$ and $x = 45$. [2]

54. The formula used in an experiment is $k = \dfrac{x}{x + 2y}$.

(a) Find the value of k when $x = 6$ and $y = 4$, expressing your answer as a fraction in its lowest terms. [1]

(b) Express x in terms of k and y. [3]

55. Simplify the following expressions:

(a) $\dfrac{4a^3b}{8ab^2}$ (b) $\dfrac{3a^2b}{6ab^5}$

(c) $\dfrac{(4ab)^2}{8ab^3}$ (d) $\dfrac{ab^5}{(a^2b)^4} \times \dfrac{(a^3b)^2}{ab^4}$

(e) $\dfrac{(xy)^2}{x^3y^5} \div \dfrac{2x^3y}{(4x^2y^3)^2}$ (f) $\dfrac{a^3b}{b^2c^4} \div \dfrac{(abc)^3}{a^4b^5c}$

(g) $\dfrac{5xy}{x^3y} \times \dfrac{4xy^5}{(2xy)^3}$ (h) $\dfrac{a^3b^4}{c^5} \div \dfrac{(bc)^2}{ab^2c^4}$ [8]

56. Express the following as fractions with a single denominator:

(a) $\dfrac{x}{3} + \dfrac{x+2}{6}$ (b) $\dfrac{2x}{5} + \dfrac{x-7}{10}$

(c) $\dfrac{2x}{7} + \dfrac{x}{6} - \dfrac{x}{21}$ (d) $\dfrac{x-4}{4} - \dfrac{2x-3}{6}$

(e) $\dfrac{x+2}{3} + \dfrac{x}{4} - \dfrac{x-3}{5}$ (f) $\dfrac{3}{x-y} + \dfrac{1}{y-x}$

(g) $\dfrac{2}{ab} + \dfrac{3}{bc} - \dfrac{1}{ac}$ (h) $\dfrac{3}{a} - \dfrac{2}{ab} + \dfrac{1}{abc}$ [8]

57. Solve the following equations:

(a) $\dfrac{3x-7}{4} = \dfrac{x+2}{5}$ (b) $\dfrac{x}{5x-2} = \dfrac{4}{7}$

(c) $\dfrac{5}{x+7} = \dfrac{6}{2x-5}$ (d) $\dfrac{5}{x-2} + \dfrac{4}{2-x} = \dfrac{3}{x+7}$

(e) $\dfrac{6x-11}{2} - \dfrac{5x-7}{4} = \dfrac{x}{6}$ (f) $\dfrac{2x-9}{3} - \dfrac{x-4}{5} = \dfrac{x}{7}$

(g) $\dfrac{7}{2x-5} + \dfrac{3}{4x-10} = \dfrac{6}{x-4}$ (h) $5 - \dfrac{x+4}{6} = 3x$ [16]

58. Make each letter in the brackets below the subject of the formula:

(a) $5x+2y=3-y$ ***(y)***

(b) $7x-4y+2z=5$ ***(z)***

(c) $x = \frac{3y+1}{5y-2}$ ***(y)***

(d) $\frac{1}{x}+\frac{2}{y} = 3$ ***(y)***

(e) $\frac{1}{x-2} = \frac{y}{2x-3}$ ***(x)***

(f) $x - \frac{k}{y} = 3c$ ***(y)***

(g) $x + \frac{kx}{t} = 2y$ ***(t)***

(h) $x^2 = \frac{5y+h}{3y+k}$ ***(y)*** [16]

59. A water tank can be filled by a copper pipe in 10 minutes operating singly and by a plastic pipe in 15 minutes operating singly. If the two pipes are used to fill the tank at the same time, how long will it take? [3]

60. It takes a boy 12 hours to clean the school hall. However the school's sweeper will only take 8 hours to clean the same hall. If they work together, how long will it take? [3]

61. If one–fifth of a number is added to one–seventh of the number, the result is 12. Find the number. [2]

62. The numerator of a fraction is 4 less than the denominator. If both the numerator and the denominator are increased by 3, the result is equal to $\frac{3}{5}$. Find the original fraction. [3]

63. An inlet tap for a water tank can fill the tank in 8 hours while the outlet tap can drain the tank in 12 hours. How long will it take to fill up the tank if both the taps are left? on? [3]

64. Ahmad and Kumar can unload the goods from a large container in 8 hours when working together. Ahmad can unload the container in 12 hours if he works alone. After working together for 6 hours, Kumar left for some urgent matters. How long will Ahmad take to complete the remaining job working alone? [3]

Answers

1.
Ans: $6a^2 b^2 c^2$; $180a^4 b^5 c^5$

2.
Ans: $\dfrac{2x^2 + 2y}{3x^2}$

3.
Ans: $\dfrac{3 + 5x}{1 - x^2}$

4.
Ans: $\dfrac{5x + 3}{2a}$

5.
Ans: (a) $\dfrac{20c - 24b + 5a}{30abc}$

(b) $\dfrac{3ab - 3b + 4a}{ab}$

(c) $\dfrac{5 - x}{4}$

6.
Ans: (a) $\dfrac{4a}{5}$

(b) $\dfrac{-4x - 7}{12}$

7.
Ans: (a) $x - 1$

(b) $\dfrac{5x^2 + x - 8}{x^2 - 1}$

8.
Ans: (a) $\dfrac{x - 7}{(x - 2)(x - 3)}$

(b) $\dfrac{x + 2}{(x - 3)(x - 4)}$

9.
Ans: (a) $\dfrac{80-11x}{12}$

(b) $\dfrac{49-22a}{30}$

10.
Ans: $\dfrac{1}{t-1}$

11.
Ans: $-1\ 17/19$

12.
Ans: (a) $\dfrac{2b-7b}{a-b}$

(b) $\dfrac{11x-7y}{24}$

13.
Ans: (a) $\dfrac{5x+8}{(x+5)(2x-7)}$

(b) 2 3/11

14.
Ans: (a) $x = 1\ 2/3$

(b) $y = \dfrac{4(x-3)}{x+1}$

15.
Ans: $\dfrac{4x-11}{x^2-9}$

16.
Ans: 2/5

17.
Ans: $y = \left(\dfrac{2x}{x-2}\right)^2$

18.
Ans: $x = y^2 + 4y + 7$

19.
Ans: $\dfrac{4c}{6a-1}$

20.
Ans: $\dfrac{(a+b)(a-b)^2}{ab(b-c)}$

21.
Ans: $a = \dfrac{15y - 4x}{3x - 10}$

22.
Ans: (a) 6/19
(b) $r = \dfrac{q - 2pq}{p}$

23.
Ans: $b = \dfrac{3a - 2}{1 + a}$; 2/38

24.
Ans: $y = \dfrac{6a^2 - x}{1 + 3a^2 x}$

25.
Ans: $\dfrac{8a + b}{6(x - 2y)}$

26.
Ans: (a) $\dfrac{v - u}{t}$

(b) 16

27.
Ans: (a) a= $\dfrac{v - u}{t}$

(b) 16

28.
Ans: a = $\dfrac{2x - y}{x}$; - ½

29.
Ans: (a) $\dfrac{x + 11}{(x-1)(x+3)}$

(b) $x = -11$

30.
Ans: $\dfrac{x}{x^2 - 4}$

31.
Ans: $\dfrac{12}{3x - y}$

32.
Ans: $\dfrac{20ab}{15b - 24a}$; 2 2/9

33.
Ans: $b = \dfrac{3c}{1 + 2ac}$; ¼

34.
Ans: $y = \dfrac{2(5 + 4x)}{8x - 15}$

35.
Ans: $y = \dfrac{3x}{2 - 4xz}$

36.
Ans: $x = \dfrac{3p + 5}{p - 4}$

37.
Ans: $\dfrac{8x + 6}{25x^2 - 15x + 2}$

38.
Ans: $\dfrac{22 - 2x}{3x + 9}$

39.
Ans: – 7 4/17

40.
Ans: $y = \dfrac{3a(x - 2)}{8}$

41.
Ans: $\dfrac{8x - 6}{x^2 - 1}$

42.
Ans: $\frac{4x - 12x^2}{9x + 4}$

43.
Ans: (a) $\frac{x + 1}{8x}$

(b) $\frac{8}{x - y}$

44.
Ans: 8 2/3

45.
Ans: (a) 3 1/7

(b) 8

46.
Ans: (a) 2 or – 1 ½

(b) –1 or –2

47.
Ans: (a) 1 50/87

(b) 1 8/9

48.
Ans: 1 4/45

49.
Ans: 5 1/3

50.
Ans: 3

51.
Ans: 5 hours

52.
Ans: 32, 16

53.
Ans: (a) $x = \dfrac{180\,(p - 2r)}{\pi r}$

(b) $r = \dfrac{180\,p}{360 + \pi x}$

(b) 7

54.
Ans: (a) 3/7

(b) $x = \dfrac{2\,ky}{1 - k}$

55. Ans: (a) $\dfrac{a^2}{2b}$ (b) $\dfrac{a}{2b^4}$ (c) $\dfrac{2a}{b}$ (d) $\dfrac{1}{a^2 b}$

(e) $8y^2$ (f) $\dfrac{a^4 b}{c^6}$ (g) $\dfrac{5y^2}{2x^4}$ (h) $\dfrac{a^4 b^4}{c^3}$

56. Ans: (a) $\dfrac{3x+2}{6}$ (b) $\dfrac{5x-7}{10}$ (c) $\dfrac{17x}{42}$ (d) $\dfrac{-x-6}{12}$

(e) $\dfrac{23x+76}{60}$ (f) $\dfrac{2}{x-y}$ (g) $\dfrac{2c+3a-b}{abc}$ (h) $\dfrac{3bc-2c+1}{abc}$

57. Ans: (a) $3\dfrac{10}{11}$ (b) $\dfrac{8}{13}$ (c) $16\dfrac{3}{4}$ (d) $6\dfrac{1}{2}$

(e) $2\dfrac{7}{19}$ (f) $6\dfrac{27}{34}$ (g) $-1\dfrac{1}{7}$ (h) $1\dfrac{7}{19}$

58. Ans: (a) $y = \dfrac{1}{3}(3-5x)$ (b) $z = \dfrac{1}{2}(5+4y-7x)$ (c) $y = \dfrac{1+2x}{5x-3}$

(d) $y = \dfrac{2x}{3x-1}$ (e) $x = \dfrac{3-2y}{2-y}$ (f) $y = \dfrac{k}{x-3c}$

(g) $t = \dfrac{kx}{2y-x}$ (h) $y = \dfrac{x^2 k - h}{5-3x^2}$

59. Ans: 6 min

60. Ans: 4 h 48 min

61. Ans: 35

62. Ans: $\dfrac{3}{7}$

63. Ans: 24 h

64. Ans: 3 h

Chapter 5

Secondary 2 Mathematics
Chapter 5 Simultaneous Linear Equations

ANSWERS FOR ENRICHMENT ACTIVITIES

Just For Fun (pg 157)

The law says the poacher should neither be hanged nor be beheaded. Hence, he should be set free.

Just For Fun (pg 171)

Let x be the number of spiders, y the number of dragonflies and z the number of houseflies. We have

$$x + y + z = 20 \quad \text{———} \quad (1)$$
$$8x + 6y + 6z = 136 \quad \text{———} \quad (2)$$
$$2y + z = 19 \quad \text{———} \quad (3)$$
$$8x + 8y + 8z = 160 \quad \text{———} \quad (4)$$

Thus we have $x = 8$, $y = 7$ and $z = 5$.

(4)–(2) $\quad 2y + 2z = 24$ ——— (5)

(5)–(3) $\quad z = 5$

Secondary 2 Mathematics
Chapter 5 Simultaneous Linear Equations

GENERAL NOTES

The ability to solve equations is crucial to the study of mathematics. The teaching of the concept of solving simultaneous linear equations by adding or subtracting both sides of equations can be more easily explained (especially to weaker students) by using physical methods such as coins and notes as a form of illustration.

We have $\boxed{\$5} = \boxed{\$2} + \boxed{\$2} + \boxed{\$1}$

$\boxed{\$1} = 50¢ + 50¢$

Now, $\boxed{\$5} + \boxed{\$1} = \boxed{\$2} + \boxed{\$2} + \boxed{\$1} + 50¢ + 50¢$?

$\boxed{\$5} - \boxed{\$1} = \boxed{\$2} + \boxed{\$2} + \boxed{\$1} - 50¢ - 50¢$?

Forming one equation with one unknown only can also solve many problems involving simultaneous linear equations. Teachers can encourage brighter students to try out this method on some of the problems in the exercise.

The use of models to illustrate the working for solving simultaneous equations as shown on page 164 is especially helpful since most students have been trained to use this method during their upper primary school years.

However, teachers should try to win them over to use algebraic methods, as it is the building block of further mathematics.

Common Errors Made By Students

The most common error occurs when students are careless in the multiplication or division of both sides of an equation and they forget that all terms must be multiplied or divided by the same number throughout.

For example,
1. $x + 3y = 5$ is taken to imply $2x + 6y = 5$.

2. $5x + 15y = 14$ is taken to imply $x + 3y = 14$.

XYZ SECONDARY SCHOOL

Name: _________________ (   )   Date: ____________
Time allowed: min
Class: _______   Marks:

Secondary 2 Multiple-Choice Questions
Chapter 5   Simultaneous Linear Equations

1. Solve the simultaneous equations: $x+\frac{2}{3}y=12\,;\frac{1}{5}x-2y=12$.

   (A) x = 11, y = 15   (B) x = 15, y = $-4\frac{1}{2}$ (C) x = 7, y = –13

   (D) $x=14\frac{2}{3}, y=-7\frac{5}{7}$ (E) None of the above   (   )

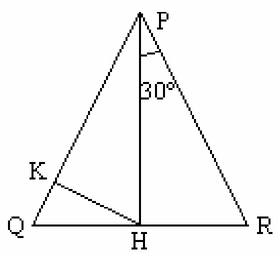
2. Find the coordinates of the points of intersection of the lines 4x =3y and 2x + 3y=18.

   (A) (3, 4)   (B) (3, 3)   (C) (4, 3)

   (D) (2, $4\frac{2}{3}$)   (E) None of the above   (   )

3. In the figure, PQ = PR, PH = PK and $\angle$RPH = 30°, calculate $\angle$QHK.

   (A) 7.5°
   (B) 10°
   (C) 15°
   (D) 20°
   (E) 30°



(   )

4. If 2x + 3y = 9 and 3x + 2y = 16, calculate the value of 3x – 2y.

   (A) 17   (B) 19   (C) 30   (D) 22   (E) 24

   (   )

5. If $\frac{1}{x}+\frac{1}{y}=4$ and $\frac{3}{x}-\frac{1}{y}=8$, calculate the value of x.

   (A) $\frac{1}{12}$ (B) $\frac{1}{2}$ (C) $\frac{1}{3}$ (D) $1\frac{1}{2}$ (E) $\frac{1}{4}$

   (   )

6. The expression $px + q$ takes the values of 8 and 4 when $x = 1$ and -1 respectively. Find p and q.
(A) $p = 6$, $q = 2$ (B) $p = 2$, $q = 6$ (C) $p = 4$, $q = 4$
(D) $p = 2$, $q = 4$ (E) Cannot be solved
( )

7. Solve the simultaneous equations: $2x + 3y = 10$; $4x + 6y = 21$.
(A) $x = 2$, $y = 2$ (B) $x = 3.5$, $y = 1$ (C) $x = 0$, $y = 0$
(D) $x = 0.5$, $y = 3$ (E) No solution
( )

8. Solve the simultaneous equations: $5x - 2y = 7$; $6y = 15x - 21$.
(A) $x = 23$, $y = 4$ only (B) $x = 1.5$, $y = 0.5$ only
(C) No solution (D) There are infinitely many solutions
(E) $x = 6$, $y = 8$ only
( )

9. Solve the simultaneous equations: $\frac{5}{x} + \frac{2}{y} = \frac{5}{6}$; $\frac{4}{x} + \frac{3}{y} = \frac{9}{10}$.
(A) $x = 10$, $y = 6$ (B) $x = 10$, $y = \frac{1}{6}$ (C) $x = 6$, $y = 10$
(D) $x = \frac{1}{10}$, $y = 6$ (E) No solution ( )

Answers

1. B	2. A	3. C	4. C	5. C
6. B	7. E	8. D	9. A	

XYZ SECONDARY SCHOOL

Name: ________________ (   )   Date: ____________
Time allowed: min
Class: _______   Marks:

Secondary 2 Mathematics Test
Chapter 5 Simultaneous Linear Equations

1. Solve the simultaneous equations:
$2x + 3y = 15$; $5x - 3y = 6$. [2]

2. Solve the simultaneous equations:
$3x + 2y = 1$; $x - 3y = 15$. [3]

3.Solve the simultaneous equations:
$3x - 4y = 7$; $3x - 5y = 5$. [2]

4. Solve the simultaneous equations:
$7x - 3y = 67$; $3x + 2y = 9$. [3]

5. Solve the simultaneous equations:
$4x + y = 3$; $2x + 3y = 29$. [3]

6. Solve the simultaneous equations:
$7x - 4y = 6$; $3x + 4y = -26$. [2]

7. Solve the simultaneous equations:
$5x - 4y = 23$; $7x + 3y = 15$. [3]

8. Solve the simultaneous equations:
$7x + 3y = 5$; $5x - 9y = 37$. [3]

9. Solve the simultaneous equations:
$4x - 3y = 11$; $3x + 6 = 7y$. [3]

10. Solve the simultaneous equations:
$3x + 2y + 4 = 0$; $3y = 2x - 19$. [3]

11. Solve the simultaneous equations:
$0.5x - y = -1$; $\frac{1}{4}x + 2y = 12$. [3]

12. Solve the simultaneous equations:
$3x - 2y = 4$; $2x - 3y = 18$. [3]

13. Solve the simultaneous equations:
$5x + 3y = 5\frac{1}{2}$; $3x - 4y = 12$. [3]

14. Solve the simultaneous equations:

$$\frac{3x-1}{4}=\frac{2y+7}{3}\ ; \qquad 3x-y=17 \qquad [3]$$

15. Solve the simultaneous equations:

$$3x+5y=8\ ; \qquad 2x-5y=9. \qquad [3]$$

16. Solve the simultaneous equations:

$$4x-5y-41=0\ ; \qquad 5x+4y=0. \qquad [3]$$

17. Solve the simultaneous equations:

$$\frac{x+1}{3}=5-\frac{y-1}{2}\ ; \qquad \frac{2x+5}{3}-\frac{y+1}{4}=3 \qquad [4]$$

18. Solve the simultaneous equations:

$$\frac{1}{x}+\frac{1}{y}=12\ ; \qquad \frac{1}{x}-\frac{1}{y}=4 \qquad [3]$$

19. Solve the simultaneous equations:

$$\frac{2}{x}+\frac{3}{y}=14\ ; \qquad \frac{4}{x}-\frac{2}{y}=12 \qquad [4]$$

20. Solve the simultaneous equations:

$$0.4x+0.6y=6\ ; \qquad 4.2x-0.7y=7 \qquad [4]$$

21. Solve the simultaneous equations:

$$1.5x+\frac{1}{2}y=6\ ; \qquad 2x+5.6=5y \qquad [4]$$

22. Solve the simultaneous equations:

$$\frac{x}{0.2}-\frac{y}{0.3}=7\ ; \qquad 5x+4y+4=0 \qquad [4]$$

23. Solve the simultaneous equations:

$$\frac{x}{2}-\frac{y}{3}=7\ ; \qquad \frac{x}{3}+\frac{y}{4}+1=0 \qquad [4]$$

24. A farmer rears goats and chickens. If there is a total of 27 heads and 78 legs, how many goats are there? [4]

25. The sides of an equilateral triangle are $(2y + 3)$cm, $(x + 2)$cm and $(x + y - 1)$ cm. Find the perimeter of the triangle. [4]

26. 5 computer ribbons and 7 diskettes cost $28 while 6 computer ribbons and 9 diskettes cost $34.50. Find the cost of each computer ribbon and each diskette. [4]

27. If 3 kg of sugar and 4 kg of flour cost $6.80 while 2 kg of sugar and 7 kg of flour cost $8.00, find the total cost of 6 kg of sugar and 5 kg of flour. [4]

28. A rectangle of sides x cm and y cm has an area of 72 cm^2 . Another rectangle of sides $(x + 1.5)$cm and $(y - 4)$ cm has the same area. Find the values of x and y. [5]

29. If 9 wallets and 7 ties cost $300 while 6 wallets and 11 ties cost $276, find the cost of 3 wallets and 75 ties. [4]

30. When 5 is added to both the numerator and denominator of a fraction, the result becomes $\frac{1}{2}$. When 1 is subtracted from both the numerator and the denominator, the fraction becomes $\frac{1}{5}$. Find the fraction. [5]

31. 7 cans of a fizzy drink and 5 packets of apple juice cost $6.80 while 5 cans of the fizzy drink and 11 packets of apple juice cost $8.20. Calculate the cost of one can of fizzy drink and one packet of apple juice. [4]

32. Half of the sum of two numbers is equal to 42. One-third their difference is equal to 4. Find the two numbers. [4]

33. Mary counted 12 cyclists and 31 bicycle wheels at a zebra crossing. How many are bicycles and how many are tricycles? [3]

34. Muthu bought 7 erasers and 9 pencils for $6.30. Paying the same price for each item, Arun bought 6 erasers and 8 pencils for $5.50. Find the total cost of 3 erasers and 5 pencils. [4]

35. The sides of an equilateral triangle are $(3x + y)$cm, $(7x + 9y - 4)$cm and $(5x + 6y)$cm. Calculate the values of x and y. [4]

36. The sum of the ages of a mother and her daughter is 52 years. Eight years ago, the mother was eight times as old as her daughter. How old is the mother now? [4]

37. A number which consists of two digits is equal to 4 times the sum of the digits and is less than the number formed when the digits are interchanged by 18. Find the number. [4]

38. If the larger of the two numbers is divided by the smaller, the quotient and the remainder are each 2. If 7 times the smaller number is divided by the larger, the quotient and the remainder are each 3. Find the two numbers. [5]

39. In 4 years' time, a father will be 4 times as old as his son. 2 years ago, he was 13 times as old as his son. Find their present ages. [5]

40. Divide \$128 into two parts such that one-third of the first part is less than $\frac{1}{5}$ of the second part by \$8. [4]

41. The ages of Ali and Bakar are in the ratio 4:3. In 8 years' time, the ratio of their ages will be 9:7. How old is Ali? [4]

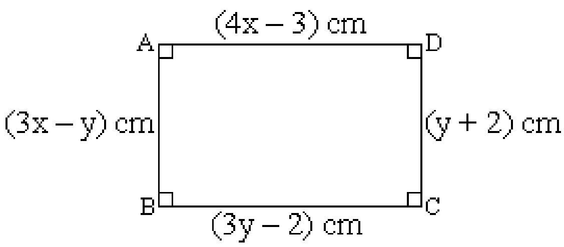
42. Find a pair of positive numbers whose sum is 35 and whose difference is 11. [4]

43. 5 Fuji apples and 8 Sunkist oranges cost \$17.20 while 3 Fuji apples and 9 Sunkist oranges cost \$13.05. Find the costs of a Fuji apple and a Sunkist orange respectively. [4]

44. I think of two numbers. If I add 10 to the first number, I obtain three times the second and if I add 25 to the second, I obtain twice the first. What are the two numbers? [4]

45. Two rolls of film plus 4 batteries cost \$13.60 while 5 rolls of film plus 6 batteries cost \$30.80. Find the cost of 1 roll of film and 1 battery. [4]

46. ABCD is a rectangle with sides AB = $(3x – y)$cm, BC = $(3y – 2)$cm, CD = $(y + 2)$cm and AD = $(4x – 3)$cm.
   (a) Form a pair of simultaneous equations in x and y. [2]
   (b) Solve the simultaneous equations to find the values of x and y. [3]
   (c) Find the area and perimeter of the rectangle. [2]



46. Solve the following simultaneous equations:

(a) $3x + y = 7$
$2x - y = 3$

(b) $5x - 3y = 3$
$5x + 7y = 43$

(c) $2x - 3y = 4$
$x - 9 = 5y$

(d) $5x - y = 3$
$8x + 3y = 14$

(e) $2x - y = 2$
$\frac{1}{3}x - \frac{3}{4}y = -9$

(f) $2x + \frac{1}{2}y = 18$
$y - \frac{3}{4}x = -2$

(g) $3x + 4y = 7$
$8x - 9y = 58$

(h) $5x - 6y = 59$
$7y + 15x = 77$

(i) $\frac{1}{2}x = \frac{1}{3}y + 4$
$\frac{2}{5}x - \frac{1}{6}y = 3\frac{1}{2}$

(j) $5(x + 2y) = 3x + 14$
$7(\frac{1}{2}x - y) = 4 - 2x$

(k) $x - \frac{1}{2}y = 5.5$
$0.4x - 0.7y = 3.7$

(l) $0.4x + 0.5y = 1.1$
$0.3x - 0.1y = 3.2$ [24]

47. Two apples and three oranges cost $2.70 while five apples and four oranges cost $5.35. Find the cost of an apple and an orange. [4]

48. Both a man's age and his son's add up to 50 years. Ten years ago the man was fourteen times as old as his son. How old was the man five years ago? [4]

49. Divide 144 into two parts so that one part is $\frac{2}{7}$ that of the other. [3]

50. The sum of the ages of both Paul and Julie is 40. Five years ago, Paul was twice as old as Julie. How old was Paul when Julie was born? [3]

51. If 1 is added to both the numerator and denominator of a fraction, the fraction becomes $\frac{1}{2}$. If 3 is subtracted from both the numerator and the denominator, the fraction becomes $\frac{3}{10}$. Find the fraction. [4]

52. The average of two numbers is 22. If one is 5 more than the other, find the large number. [4]

53. Find two numbers such that when the first is added to three times the second, the sum is 16 and when the second is added to seven times the first, the sum is 22. [3]

55. A father was four times as old as his son was seven years ago. In seven years' time, he will only be twice as old as his son. How old are they? [4]

56. The ages of Sandra and Melanie are in the ratio of 5: 3. Two years ago the ratio of Sandra's age to Melanie's age was 7: 4. How old are Sandra and Melanie? [4]

Answers

1. Ans: $x = 3$, $y = 3$
2.Ans: $x = 3$, $y = 4$
3.Ans: $x = 5$, $y = 2$
4.Ans: $x = 7$, $y = 6$
5.Ans: $x = - 2$, $y = 11$
6.Ans: $x = 2$, $y = 5$
7.Ans: $x = 3$, $y = -2$
8.Ans: $x = 2$, $y = 3-$
9.Ans: $x = 5$, $y = 3$
10.Ans: $x = 2$, $y = -5$
11.Ans: $x = 8$, $y = 5$
12.Ans: $x = - 4$ 4/5 , -9 1/5
13.Ans: $x = 2$, $y = 1$ ½
14.Ans: $x = 7$, $y = 4$
15.Ans: $x = 2$, $y = -1$
16.Ans: x = 4, $y = - 5$
17.Ans: $x = 5$, $y = 7$
18.Ans: $x =$ ½ , $y=$ 1/10
19.Ans: $x =$ ½ , $y=$ ½
20.Ans: $x = 3$, $y = 8$
21.Ans: $x = 3.2$, $y = 2.4$
22.Ans: $x = 0.4$, $y = -1.5$
23.Ans: $x = 6$, $y = -12$
24.Ans: 12
25.Ans: 27cm
26.Ans: Ribbon = $3.50, Diskette = $1.50
27.Ans: $11.20
28.Ans: $x = 4.5$, $y = 16$
29.Ans: $132
30.Ans: 3/11
31.Ans: 65 cents, 45 cents
32.Ans: 48, 36
33A.ns: 5 bicycles, 7 tricycles
34.Ans: $3.10
35.Ans: $x = 5$, $y = - 2$
36.Ans: 40 years
37.Ans: 24
38.Ans: 18, 8
39Ans: 28, 4
40.Ans: $33, $95
41.Ans: 64 years
42.Ans: 12, 23
43. Ans: $2.45, 65cents
44.Ans: 17, 9

45.Ans: \$5.20, 80 cents
46.Ans: (a) $3y - 2 = 4x - 3$; $3x - y = y + 2$ (b) $x = 4$, $y = 5$
(b) 91 cm^2; 40 cm
47.Ans: (a) x = 2, y = 1 (b) x = 3, y = 4 (c) x = –1, y = –2
(d) x = 1, y = 2 (e) x = 9, y = 16 (f) x = 8 , y = 4
(g) x = 5, y = –2 (h) x = 7, y = –4 (I) x = 10, y = 3
(j) x = 2, y = 1 (k) x = 4, y = –3 (l) x = 9, y = –5
48.Ans: Apple: 75 ¢, Orange: 40 ¢
49.Ans: 33
50.Ans: 112, 32
51. Ans: 10
52. Ans: $\frac{6}{13}$
53. Ans: $24\frac{1}{2}$
54. Ans: $2\frac{1}{2}$, $4\frac{1}{2}$
55. Ans: 14yrs, 35yrs
56. Ans: 30yrs, 18yrs

Chapter 6

Secondary 2 Mathematics
Chapter 6 Phythagoras' Theorem

GENERAL NOTES

The Exploration activity on page 178 should be a lively exercise for students to verify Pythagoras' theorem for themselves. After they are convinced of the results, the teacher can then proceed to prove the theorem. We can also ask the pupils to do a mini project on the history and development of the theorem over the years. As there are more than 300 proofs of Pythagoras' Theorem, we can ask pupils to find two of each by using the internet.

XYZ SECONDARY SCHOOL

Name: ________________ (   )   Date: ____________

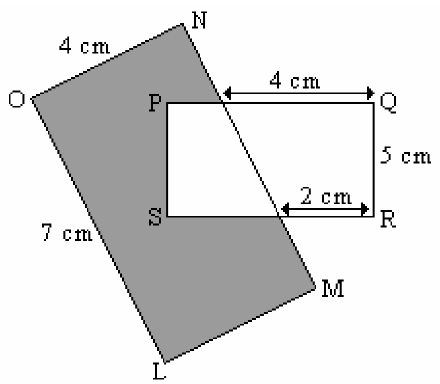
Time allowed: min

Class: _______   Marks: $\frac{\quad}{5}$

Secondary 2 Multiple-Choice Questions
Chapter 6 Phythagoras' Theorem

1. The lengths of the sides of a right–angled triangle are (14 – x) cm, (13 – x) cm and (6 – x) cm. Calculate the value of x.
   (A) 1 (B) 3 (C) 5 (D) 6 (E) 7
   (   )

2. The lengths of the sides of a right–angled triangle are (x – 1) cm, x cm and (x + 1) cm. Find the perimeter of the triangle.
   (A) 4 cm (B) $3\sqrt{2}$ cm (C) 5 cm (D) 12 cm
   (E) None of the above (   )



3. The two rectangles PQRS and OLMN overlap as shown . If the area of PQRS is 30 cm², calculate the perimeter of the shaded region in cm.
   (A) $22 - \sqrt{29}$ (B) $33 - \sqrt{29}$
   (C) 33 (D) $33 - \sqrt{21}$
   (E) None of the above (   )

4. A square of sides x cm each is inscribed in a circle of radius 2 cm. Find x.
   (A) $\sqrt{2}$ (B) 2 (C) $2\sqrt{2}$ (D) 4
   (E) None of the above (   )

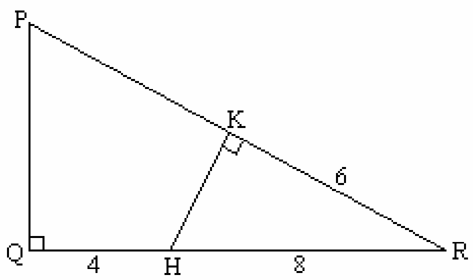
5. In the figure $\angle PQR = \angle HKR = 90°$, HR = 8 cm, QH = 4 cm and KR = 6 cm.

Calculate the length of PR in cm.

(A) 16 (B) 12 (C) 18 (D) 34

(E) None of the above

( )



Answers

1. A 2. D 3. B 4. C 5. A

XYZ SECONDARY SCHOOL

Name: _________________ (   )

Date: ____________

Time allowed: min

Class: _______

Marks:

Secondary 2 Mathematics Test
Chapter 6 Phythagoras' Theorem

1. A B C D is a square of side 15cm, find the length of the diagonal A C. [2]

2. P Q R S is a rectangle in which PQ = 24cm and QR = 15cm, find the length of the diagonal QS.[2]

3. A B C D is a square in which BD = 16cm, calculate the area of the square ABCD. [2]

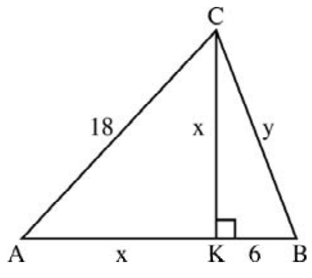
4. PQR is a equilateral triangle of side 14cm. Calculate the altitude of the triangle and find its area. [4]

5. A 5.4m long ladder leans against a vertical wall with its top at a height of 4.2m above the ground. Find the distance of the base of the ladder from the wall. [2]

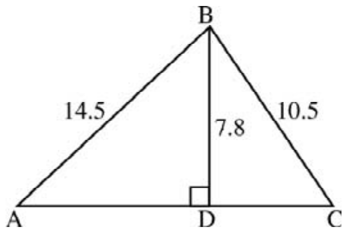
6. The length of s triangle ABC are AB = 5cm, BC = 4.8cm and AC = 1.4cm. State with reasons whether $\triangle$ ABC is a right-angled triangle. [3]

7. In the right –angled triangle ABC, $\angle$ABC = 90º, AB = 8cm and AC = 14cm, calculate the perimeter and area of $\triangle$ ABC. [4]

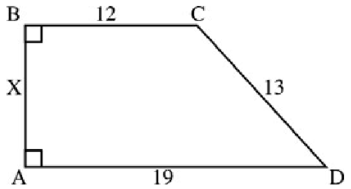
8. In the diagram, $\angle$CKB = 90º, KB = 6cm AC = 18cm and AK = CK = *x* cm. Calculate
   (a) the volume of *x* and *y*.
   (b) the area of $\triangle$ CKB. [4]



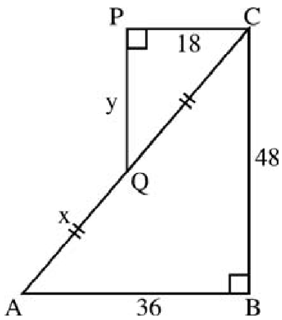
9. In the figure BD is a perpendicular AC, AB = 14.5cm, BD = 7.8cm, and BC = 10.5cm, calculate the area of △ ABC. [3]



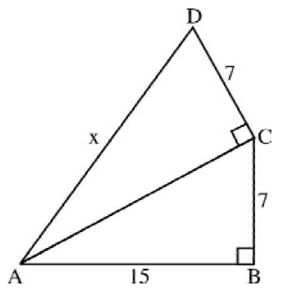
10. ABCD is a trapezium, calculate the value of *x* and the area of the trapezium. [4]



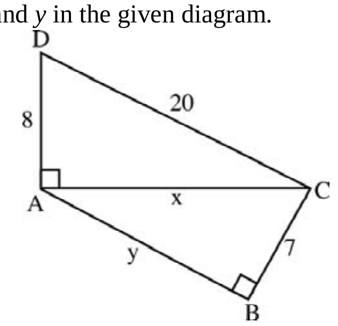
11. Calculate the values of *x* and *y* in the given diagram. [4]



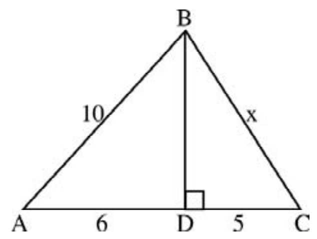
12. Find the value of the x giving your answers correct to 2 decimal places. [3]



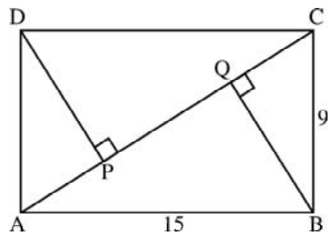
13. Find the values of x and y in the given diagram. [4]



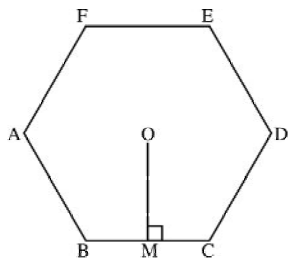
14. Find your values of the x in the given diagram. [3]



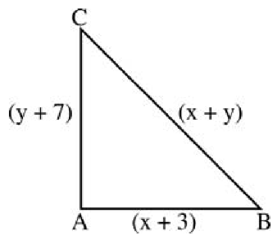
15. ABCD is a rectangle of length 15cm and width 9cm. Given that ∠BQR = ∠DPC = 90, calculate
(a) AC
(b) BQ
(c) PQ [6]



16. ABCDEF is a rectangular hexagon of side of side 12 cm. O is the centre of the hexagon and M is the mid-point of BC. Calculate
(a) ∠BAF,
(b) the length of O M. [4]



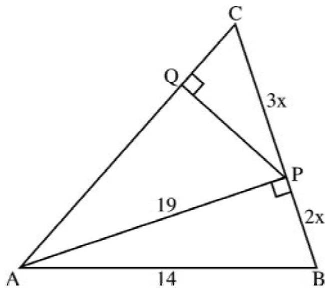
17. In the right angle-triangle ABC, AB (x + 3) cm, AC = (y + 7) cm and BC = (x + y) cm. Express x in terms of y. [3]



18. The width of a rectangle is 21cm. Shorter than its length and its diagonal is 24cm longer than is 24cm longer than its width, find the perimeter and area of the rectangle. [4]

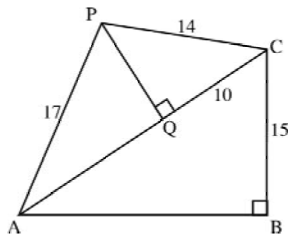
19. ABCD is a rectangle in which AB =3x cm, BC = (x-1)cm and AC = (3x +1)cm. Calculate
(a) the value of x,
(b) the area and perimeter of ABCD. [6]

20. In the diagram, A^PB, = A^QP = 90º, AB= 14cm, AP = 19cm, BP=2x cm and CP = 3$x$cm.
Calculate (a) the value of x (b) PQ (c) AQ [6]



21. The length of the right-angled triangle ABC where ∠ABC = 90º, AB = (3x +1) cm, 13 C = (x – 4) and AC = (3x +2)cm. Calculate the value of x and find the area and find the area and perimeter of △ ABC. [4]

22. In the diagram, ∠ABC = ∠AQP = 90º, AP = 17cm, PC = 14cm, CQ = 10cm and BC = 15cm, calculate (a) PQ, (b) AC, (c) the area of △ ABC . [6]

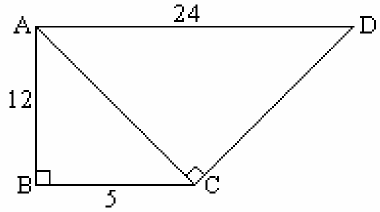


23. The side of a right-angled triangle ABC are AB = (x + 3)cm BC = (4x – 1)cm and AC = (4x +1)cm. Calculate (a) the volume of x, (b) the area of △ ABC, (c) the length of the perpendicular from B to AC. [6]

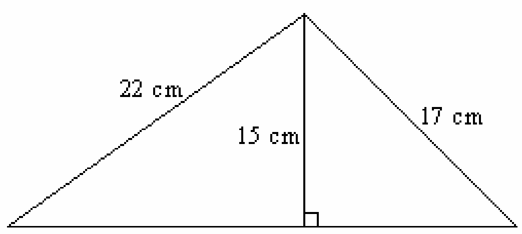
24. Which of the following triangles with sides as given below is a right-angled triangle?
(a) 48cm, 50cm, 14cm
(b) 34cm, 30cm, 16cm
(c) 81cm, 75cm, 30cm
(d) 66cm, 23cm, 70cm
(e) 53cm, 45cm, 28cm [5]

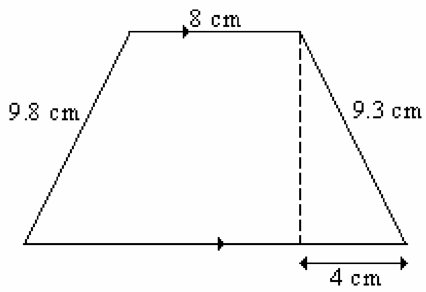
25. A rope is tied from the top of a vertical pole to a point 3.2 m from the foot of the pole. If the pole is 8.2 m high, how long is the rope? [3]

26. In figure, ∠ABC =∠ACD = 90°, AB = 12 cm, BC = 5 cm and AD = 24 cm. Calculate the length of CD. [3]



27. Find the perimeter and area of each of the following figures: [4]





28. The lengths of the sides of a right–angled triangle are (3x – 2) cm, (4x + 5) cm and (6x – 7) cm. Form an equation in x and solve it. With this value of x, find the perimeter of the triangle. [4]

29. PQRS is a rectangle in which PQ=6.4 cm, PS=4.8 cm and T is a point on SR produced such that the area of triangle PST is equal to the area of PQRS. Calculate the length of ST and PT giving your answer correct to 2 decimal places. [4]

30. PQR is an isosceles triangle in which PQ=PR, PA is perpendicular to QR and QB is perpendicular to PR. Given that QR=10 cm and PA=14 cm, calculate the length of PQ and QB giving your answer correct to 2 decimal places. [4]

31. ABCD is a rectangle in which AC meets BD at Q and triangle ADQ is equilateral. P is a point on AD such that PA=2PD. If BC=12 cm, calculate the length of PC and PQ, giving your answer correct to 2 decimal places. [4]

Answers

1.Ans: 21.21cm
2.Ans: 28.30cm
3.Ans: 128 cm^2
4.Ans: 12.12cm, 84.87cm^2
5.Ans: 3.394m
6.Ans: yes, 5 (2) = 4.8 (2) + 1.4 (2)
7.Ans: 33.49cm, 45.96cm^2
8.Ans: (a) x = 12.73cm, y = 14.07cm (b) 38.18cm^2
9.Ans: 75.08cm^2
10.Ans: 10.95cm, 169.8cm^2
11.Ans: $x = 30$, $y = 24$
12.Ans: 17.97cm
13.Ans: $x = 18.33$, $y = 16.94$
14.Ans: 9.434
15.Ans: (a) 17.49cm (b) 7.72cm (c) 8.23cm
16.Ans: (a) 120° (b) 10.39cm
17.Ans: $x = \frac{7y + 29}{y - 3}$
18.Ans: 102cm, 540cm^2
19.Ans: (a) $x = 8$ (b) 168cm^2, 62cm
20.Ans: (a) 6.423 (b) 13.53 (c) 13.34
21.Ans: x = 13, 180cm^2, 90cm
22.Ans: (a) 9.798cm, (b) 23.89cm, (c) 139.5cm^2
23.Ans: (a) x = 9 (b) 210cm^2 (c) 11 13/37cm
24.Ans: (a) Yes (b) Yes (c) No (d) No (e) Yes
25.Ans: 8.80 m
26.Ans: 20.2 cm
27.Ans: (a) 63.1 cm, 180.7 cm^2 (b) 64.15 cm, 1809 cm^2
28.Ans: x = 10; 126 cm
29.Ans: ST=12.8 cm, PT=13.67 cm
30.Ans: PQ=14.87 cm, QB=9.42 cm
31.Ans: PC=21.17 cm, PQ=10.58 cm

Chapter 7

Secondary 2 Mathematics
Chapter 7 Volume and Surface Area

GENERAL NOTES

By considering the volume of a right pyramid to be $\frac{1}{3}$ that of a prism having the same base and height as the pyramid, students may find it easier to remember the formula for the volume of a pyramid.

$$\text{volume of prism} = \text{area of base} \times \text{height}$$
$$\text{and volume of pyramid} = \frac{1}{3} \times \text{area of base} \times \text{height}$$

Similarly, students may remember the formula for the volume of a cone better if they relate it to the formula for the volume of a cylinder.

$$\textit{volume of cylinder} = \pi r^2 h$$
$$\textit{and volume of cone} = \frac{1}{3} \pi r^2 h$$

In the derivation of the formula for the volume of a cone, it can be imagined that as the number of sides of a polygon increases infinitely, the polygon will finally become a circle. Explore this important idea with students. This may prove to be useful to them later when they come across topics on **differentiation** and **integration** i.e. calculus.

NE MESSAGES

Water is a precious commodity and we must treasure it and not waste it unnecessarily.

The two questions on page 233 (Q11 and Q12) illustrate how one can play a little part in saving the precious water in our everyday life and the benefits of saving water in terms of saving money. The Singapore government is encouraging new buildings and homes that have sanitary units with the water-conserving dual flushing system. Many Singaporeans like to wash dishes with the water running. These bad habits will definitely not contribute to water conservation and will increase the PUB bills. We can bring in the problem of limitations of water supply in Singapore and the fact that more than half of the water that we are using in Singapore comes from Malaysia. The agreement for the supply of water from Malaysia expires in the year 2011 and 2061. The alternative solution to the limitations of water supply is desalination, which may be expensive. The water produced is not as tasteful as natural water. We can take this opportunity to urge all pupils to cultivate good habits of not wasting water.

XYZ SECONDARY SCHOOL

Name: _________________ (   )   Date: ____________

Time allowed: min

Class: _______   Marks: $\frac{}{9}$

Secondary 2 Multiple-Choice Questions
Chapter 7   Volume and Surface Area

[Take π to be $\frac{22}{7}$ for Q1-Q9.]

1. 1cm^3 of iron weighs 8g. The weight of an iron hemisphere of radius 3 cm is approximately
   (A) 792 g   (B) 729 g   (C) 453 g   (D) 693 g   (E) 3960 g
   (   )

2. The vertical height of a pyramid with volume 84 cm^3 and a base 9 cm by 6 cm is
   (A) $4\frac{1}{3}$ cm   (B) $4\frac{2}{3}$ cm   (C) $4\frac{1}{8}$ cm   (D) $4\frac{2}{5}$ cm   (E) $\frac{14}{27}$ cm
   (   )

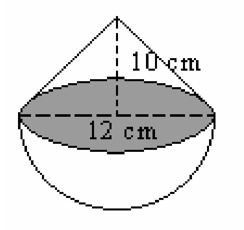
3. The surface area of a hemisphere of diameter 4 cm, correct to 1 decimal place, is
   (A) 25.1 cm^2 (B) 62.8 cm^2 (C) 37.7 cm^2 (D) 50.3 cm^2 (E) 16.8 cm^2
   (   )

4. If the volume of a cone whose height is 6 cm is 20 cm^3, then the base radius of the cone, correct to 2 decimal places is
   (A) 0.53 cm   (B) 0.18 cm   (C) 0.73 cm   (D) 1.03 cm   (E) 1.78 cm
   (   )

5. Two solid plastic spheres have surface areas 144π cm^2 and 256π cm^2 respectively. They are melted and recast to form a larger sphere. Find the approximate surface area of this sphere in cm^2.
   (A) 324π (B) 384π (C) 400π (D) 784π (E) 847π
   (   )

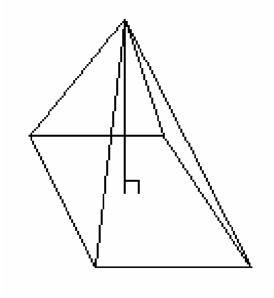
6. There are 54 solid hemispheres, each of diameter 2 cm. They are melted to form a solid cone with base diameter 6 cm. Find the height of the cone.
   (A) 4 cm   (B) 8 cm   (C) 12 cm   (D) 16 cm   (E) 24 cm
   (   )

7. The diagram shows a composite solid consisting of a cone and a hemisphere. The cone has a height of 10 cm and a base diameter of 12 cm. Find the volume of the whole solid.



(A) 264π cm³ (B) 408π cm³ (C) 504π cm³
(D) 528π cm³ (E) 648π cm³ ( )

8. The height of a square pyramid is equal to 4 cm, while the length of the sides of the base is 6 cm. Find the volume of the pyramid.



(A) 84 cm³ (B) 144 cm³ (C) 48 cm²
(D) 48 cm³ (E) 72 cm³ ( )

9. A cylinder, a sphere and a cone have the same radius and height. What is the ratio of their volumes?
(A) 3:2:1 (B) 3:1:2 (C) 1:2:3 (D) 2:3:1 (E) 1:3:2
( )

Answers

1. C 2. B 3. C 4. E 5. A 6. C 7. A 8. C 9. A

XYZ SECONDARY SCHOOL

Name: _________________ (   )   Date: ____________
Time allowed: min
Class: _______   Marks:

Secondary 2 Mathematics Test
Chapter 7   Volume and Surface Area

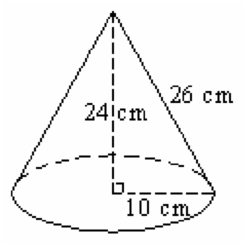
[Take π to be 3.142 for Q1-Q19.]

1. Find the volume of a pyramid with a square base of sides 3 cm and height 6 cm. [3]

2. If the volume of a pyramid is 46 cm³ and the base area is equal to 12 cm², find the height of the pyramid. [2]

3. A pyramid has a rectangular base measuring 12 cm by 7 cm. Its volume is 91 cm³. Find its height. [2]

4. Find (a) the volume, [3]
   (b) the curved surface area of the cone in the diagram.[2]



5. A solid cone has a base diameter of 24 m, a height of 9 m and a slant height of 15 m. Find
   (a) the volume and the surface area of the cone, giving your answer correct to 3 significant figures. [4]
   (b) Calculate the cost of painting the solid cone if 1 litre of paint which costs $8.20 can cover only 8 m² of area. [2]

6. A pyramid has a right-angled triangular base. The lengths of the two shorter sides of the triangular base are 15 cm and 36 cm. Find the volume of the pyramid given that its height is 29 cm. [4]

7. An open-ended cone made of a thin sheet of metal is split open along its slant edge which is 10 cm in length. If the radius of the cone is 6 cm, what is the area of the metal used for making it? [4]

8. Find the volume of each of the following, to the nearest whole number.
   (a) A sphere of radius 8 cm. [3]
   (b) A sphere of diameter 6 m. [3]
   (c) A hemisphere of diameter 10 cm. [3]
   (d) A hemisphere of radius 7 m. [3]

9. Find the surface area of each of the following, to the nearest whole number.
(a) A sphere of radius 4 cm. [3]
(b) A solid hemisphere of radius 5 m. [3]
(c) A sphere of diameter 18 mm. [3]
(d) A solid hemisphere of diameter 28 mm. [3]

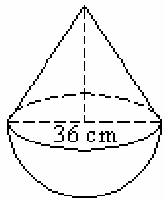
10. Find the area of a circular path 2 m wide surrounding a circular pond of radius 10 m. [4]

11. Find the radius of a sphere whose surface area is 108 cm^2. [3]

12. Find the radius of a sphere whose volume is 426 cm^3. [3]

13. A solid cone of base radius 4 cm has a total surface area of 39π cm^2. Find the slant height of the cone. [3]

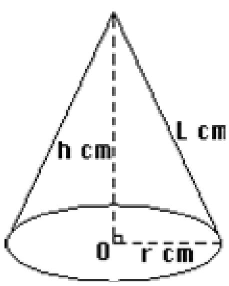
14. The diagram shows a solid consisting of a right circular cone and a hemisphere with a common circular base of diameter 36 cm. Given that the volume of the hemisphere is $\frac{7}{8}$ of the volume of the cone, find the height of the cone. [4]



15. 2 000 lead shots each of diameter $\frac{1}{2}$ cm are melted down and recast into the form of a cube. Find the length of a side of the cube. [4]

16. The curved surface area of a cone made of lead is 424 cm^2 and its slant height is 15 cm. It is melted and recast in the form of a cylinder. If the height of the cone is 12 cm and the diameter of the base of the cylinder is 8 cm, calculate the height of the cylinder, giving your answer correct to the nearest cm. [4]

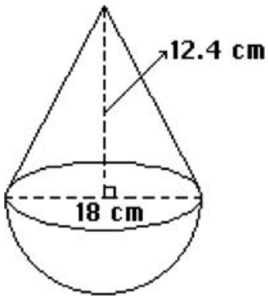
17. Given that $l = \sqrt{r^2 + h^2}$, $r = 7$ and $h = 12$, find the curved surface area and the volume of the cone. [5]



18. The figure shows a composite solid consisting of a cone and a hemisphere with a common base. The cone has a height of 12.4 cm and a base diameter of 18 cm. Find

(a) the volume, [4]

(b) the total surface area of the solid. [3]



19. (a) Calculate, correct to the nearest $\frac{1}{10}$ kg , the mass of 5 000 ball bearings, each of diameter 0.7 cm, made of metal, and of which a cubic centimetre has a mass of 6.4 g. [3]

(b) Find the total surface area of 1 750 ball bearings, each of diameter 0.35 cm. [3]

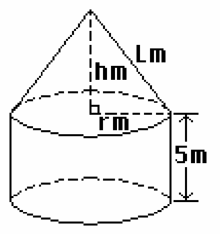
20. A solid is made up of a cylinder with a height of 5 m and a cone on its top. Using the relationship $l^2 = h^2 + r^2$, find the value of l given that h = 8 and r = 6. [1]

Taking π = 3.142, hence find,

(a) the total surface area of the solid, [3]

(b) the volume of the solid. [2]

(Leave your answers correct to 1 decimal place.)



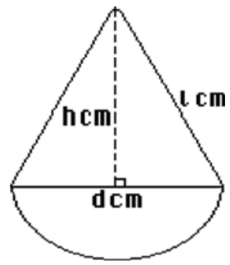
21. 1500 metal ball bearings of radius 1.4 cm are melted to form a solid rectangular bar of base area 224 cm^2 . Find the length of the bar. [4]

22. The diagram shows the cross–section of a child's join up spacing toy consisting of a solid right circular cone joined to a solid hemisphere. The height and the slant height of the cone are *h* cm and *l* cm respectively. The common radius of the cone and the hemisphere is *d* cm. Given that $d^2 = 4(l^2 - h^2)$, $h = 14$ and $l = 17\frac{1}{2}$, find the value of *d*. [1]

Hence calculate the

(a) volume of the toy, [3]

(b) surface area of the toy. [2]

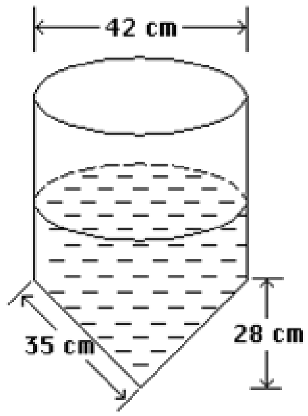


23. Calculate the height of a pyramid whose volume is 462 m^3. It has a rectangular base of 11 m by 7 m. [2]

24. The diagram shows a container in the form of a hollow cone joined to a cylinder. 15 708 cm^3 of water is poured into it. Calculate

(a) the depth of water in the container, [3]

(b) the area of the surface in contact with the water. [3]

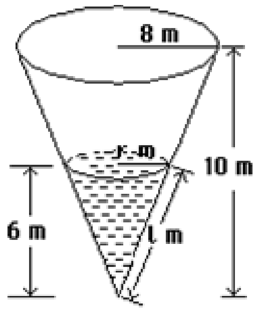


25. An inverted conical vessel has a base area of 8 m and a vertical height of 10 m. It contains cement to a depth of 6 m. Find, giving your answer correct to 1 decimal place

(a) the radius *r* of the circular cement surface, [1]

(b) the volume of the cement in the container, [2]

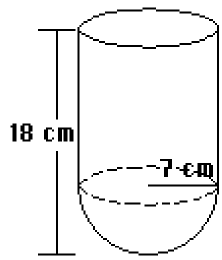
(c) the slant height *l* if the surface area of the cone for which the cement is in contact with is 116 m^2 . [1]



26. A metal solid is made of a cylinder and a hemisphere as shown.

(a) Find the total surface area of the solid. [4]

(b) Find the mass of the solid if 1 cm^3 of metal is used to make the solid weigh 4.5 g, expressing your answer correct to the nearest $\frac{1}{100}$ kg. [3]



27. A cone with a base radius of (x – 4) cm, a height of (x + 3) cm and a slant height of (x + 4) cm has a curved surface area of $204\frac{2}{7}\,\text{cm}^2$.

Find

(a) the value of x, [2]

(b) the volume of the cone, correct to three significant figures. [2]

28. A sphere with diameter (x – 3) cm has a surface area of 124.74 cm^2. Find

(a) the value of x, [2]

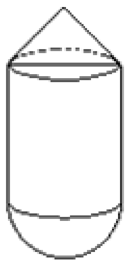
(b) the volume of the sphere correct to the nearest whole number. [2]

29. Find the surface area of a sphere whose volume is $1437\frac{1}{3}\,\text{cm}^3$. [4]

30. A solid metal sphere of radius 12 cm is melted down and recast in the form of a solid circular cylinder of length 46 cm. Find the radius of the cylinder, giving your answer correct to 1 decimal place. [3]

31. A solid metal sphere of surface area 394.24 cm^2 is melted down and recast as a solid circular cone of height 5.6 cm. Find the base radius of the cone. [4]

32. A solid consists of a cylinder of diameter 8 cm sandwiched between a cone and a hemisphere of the same diameter. If the cone is of height 10 cm and the cylinder is of height 12 cm, find the total volume of the solid. [4]



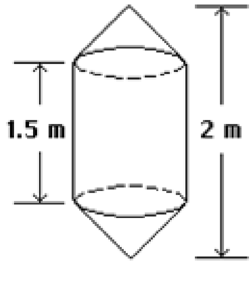
33. A solid consists of a cone attached to a hemisphere of radius 6 cm. If the total height of the solid is 15 cm, find its volume. [3]

34. A spherical balloon has a surface area of $144\pi\,\text{cm}^2$. If the radius of the spherical balloon is increased by 1 cm, find the new surface area of the balloon. [3]

35. 13 500 spherical drops of water are needed to completely fill a conical container. Each spherical drop of water has a diameter of $\frac{1}{5}$ cm and the height of the conical container is twice the length of the base radius. What is the height of the conical container? [4]

36. A cylindrical container of diameter 8 cm contains water to a depth of 5 cm. 120 metal spheres each of diameter 0.4 cm are dropped into the container. Find the rise in the water level. [3]

37. An oil storage tank consists of a cylindrical section and two identical conical ends. The height of the cylindrical section is 1.5 m and the total height of the tank is 2 m. If the capacity of the tank is 33 m^3, find the diameter of the cylindrical section. [4]



38. A solid metal sphere of radius 14 cm was melted and recast to form 49 smaller hollow spheres each of external diameter of 4 cm. Find the internal diameter of each hollow sphere. [4]

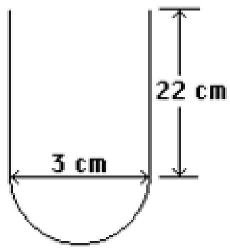
39. A hemispherical bowl of internal diameter 12 cm is full of water. It is emptied into an empty cylindrical glass with an internal diameter of 8 cm. Find the depth of water in the glass. [3]

40. A conical container has an internal diameter of 60 cm and its internal height is 1 m and 15 cm. When empty, its mass is 8 kg.
(a) Find the total mass in kg if the container is full of oil and the oil weighs 560 kg/cm³.
(b) How many times can the oil in the container fill a hemispherical bowl of diameter 10 cm?
[4]

41. A cylindrical jar of radius 4 cm is partly filled with water. 2 000 identical iron spheres of diameter 0.6 cm are put into the jar so that all spheres are completely immersed. Find the rise in the level of water, assuming that the water does not overflow. [4]

42. A rectangular block of lead, 4.5 cm by 8 cm by 10 cm, was melted down and recast into solid spheres of radius 1.5 cm. Calculate the number of complete solid spheres that can be produced.
[4]

43. A test–tube consists of a cylinder with a hemispherical base. The diameter of the hemisphere is 3 cm and the height of the cylinder is 22 cm, both being internal measurements. A mark is made on the test–tube when it is half–full. Find the height of this mark above the lowest point of the test–tube.
[5]



44. A quantity of metal weighing 95 kg is melted down and made into a cone of height 0.6 m. If the metal weighs 4.6 g per cm^3, find to the nearest 0.1 metre, the radius of the base of the cone.
[5]

45. The diameter of a hemispherical bowl is 42 cm. Water flows into it at the rate of 16 km per hour from a cylindrical pipe that is 1.2 cm in diameter. Find, correct to the nearest second, the time it will take to fill the bowl. [5]

46. A cylindrical container has a diameter of $\frac{2}{3}$ m. If the container contains water that is sufficient to fill up 12 hemispheres of diameter $\frac{1}{3}$ m, find the depth of the water in the container. [4]

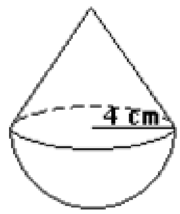
47. A solid cone of base radius 4 cm and height 10 cm is made of steel of density of $8.2\ g/cm^3$. Find the mass of the solid, in kg. [3]

48. A solid sphere of diameter 6 cm is made of metal that has a density of 7.6 g per cm^3. Find the mass of the solid, in kg. [3]

49. The figure is a solid consisting of a right circular cone and a hemisphere with a common base which is a circle of radius 4 cm. The volume of the hemisphere is equal to $\frac{4}{3}$ the volume of the cone.

Find (a) the height of the cone, [3]

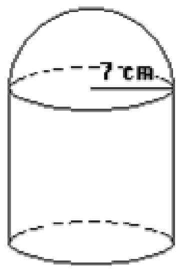
(b) the mass of the solid, in kg, given that it is made of steel with a density of 8.2 g per cm^3. [3]



50. The figure shows a solid consisting of a cylinder and a hemisphere with a common base which is a circle of radius 7 cm. The volume of the hemisphere is $\frac{7}{12}$ the volume of the cylinder. Find

(a) the height of the cylinder, [2]

(b) the surface area of the whole solid. [3]

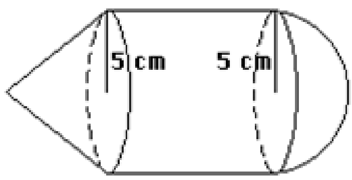


51. The figure shows a solid consisting of a cone, a cylinder and a hemisphere. The common base between the cone and the cylinder and the common base between the cylinder and the hemisphere are circles with the same radii of 5 cm. The ratio of the volumes of the cone, the cylinder and the hemisphere is 6 : 15 : 5. Find,

(a) the height of the cone, [2]

(b) the height of the cylinder, [2]

(c) the mass of the solid, in kg and correct to 1 decimal place, given that it is made of metal of the density $6.5\ g/cm^3$. [4]



52. A pyramid has a right angled triangular base, and a volume of $270cm^3$. If the shorter sides of the base are 5cm and 12cm long, find the height of the pyramid. [3]

53. The net of a pyramid consists of a square of side 28cm with four congruent isosceles triangle of base 28cm and height 50cm. Calculate
   (a) the total surface area of the pyramid [3]
   (b) the height and volume of the pyramid. [4]

Answers

1. 18 cm^3

2. $11\frac{1}{2}$ cm

3. $3\frac{1}{4}$cm

4. (a) 2 513.6cm^3 (b) 188.52cm^2

5. (a) 1 360 m^3, 1 020 m^2 (b) $1 045.50

6. 2 610 cm^3

7. 188.52 cm^2

8. (a) 2 145 cm^3 (b) 113 m^3 (c) 262cm^2 (d) 718m^3

9. (a) 201 cm^3 (b) 236 m^2 (c) 1 018 mm^2 (d) 1 847 mm^2

10. 138.2 m^2

11. 2.9 cm

12. 4.7 cm

13. $5\frac{3}{4}$ cm

14. $41\frac{1}{7}$cm

15. 5 cm

16. 20 cm

17. 306 cm^2, 616 cm^3

18. (a) 2 580 cm^3
    (b) 942 cm^2

19. (a) 5.7 kg
    (b) 673cm^2

20. 10
(a) 490.2 m^2
(b) 867.2 m^3

21. 77 cm

22. d = 21
(a) 4040 cm^3
(b) 1270 cm^2

23. 6 m

24. (a) 30 cm
(b) 2 570 cm^2

25. (a) 4.8 m
(b) 144.8 m^3
(c) 7.7 m

26. (a) 946 cm^2
(b) 10.85 kg

27. (a) 9
(b) 314 cm^3

28. (a) 9.3
(b) 131cm^3

29. 616 cm^2

30. 7.1 cm

31. 11.2 cm

32. 905 cm^3

33. 792 cm^3

34. 616 cm^2

35. 6 cm

36. 0.08 cm

37. 5.02 m

38. 2 cm

39. 9 cm

40. (a) 60695578 kg
(b) 414

41. 4.5 cm

42. 25

43. 12.0 cm

44. 0.181 m

45. 39 seconds

46. $\frac{1}{3}$ m

47. 1.37 kg

48. 0.860 kg

49. (a) 6 cm
(b) 1.92 kg

50. (a) 8 cm
(b) 814 cm^2

51. (a) 12 cm
(b) 10 cm
(c) 8.85 kg

52. 27 cm

53. (a) 3584 cm^2
(b) 48cm, 12 544 cm^3

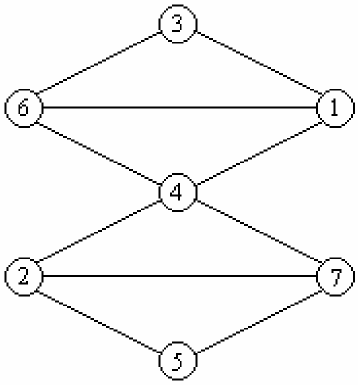
Chapter 8

Secondary 2 Mathematics
Chapter 8 Graphs of Linear Equations in Two Unknowns

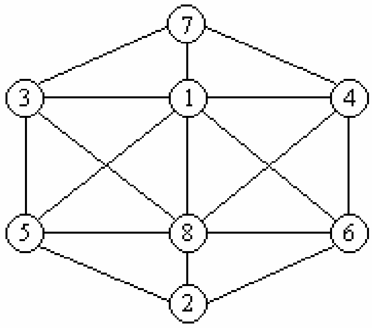
ANSWERS FOR ENRICHMENT ACTIVITIES

Just For Fun (pg 250)
Encourage discussion on whether the solution to Puzzle 1 is unique. In other words, encourage alternative answer which is the spirit of heuristics.

1.



2.



In Puzzle 2, lead students to the conclusion that the central vertical column is unique: the central two circles are linked to every other circle except one i.e. the highest (or lowest) circle. This gives us the clue to put 1 and 8 in the central circles and work out the rest.

Secondary 2 Mathematics
Chapter 8 Graphs of Linear Equations in Two Unknowns

GENERAL NOTES

At the beginning of this chapter, the teacher may help students to revise what they have learnt in Secondary 1 – Functions and Graphs.

1. The coordinate plane is made up of two intersecting number lines namely the x-axis (the horizontal line) and the y-axis (the vertical line).

2. An axis is a number line ranging from negative values to positive values which helps to locate a point in the coordinate plane.

3. The ordered pairs (x, y) with (0, 0) as the origin represent the intersection of the two axes.

4. When choosing the proper scale, check the biggest and lowest values available to allow enough space to plot the graph. Ideally, the line should cross the axes.

5. The standard form of linear equation is $y=mx + c$, where m is the gradient of the line and c is the y-intercept.

The Dynamic Mathematics Series on "**The Business of GRAPHS**" will provide extra drill and practice for the pupils if your school do have these CDs.

Go through the tutorials and activities.

Activity on Equations of lines parallel to the *x*- and *y*-axes

1. Switch on the computer, put the CD-ROM into the CD-Drive, and close the Drive.
2. Click on Start, Programme, The Dynamic Mathematics Series and The Business of GRAPHS .
3. The program will begin with music and graphics of a detective entering a high-tech building. Please enjoy the sight and sound and wait for the main Menu to appear.
4. Click on the map and select Cartesian pattern. There are 3 tutorials T1 to T3. Go through each of them until you understand the concepts and able to answer the questions posed.

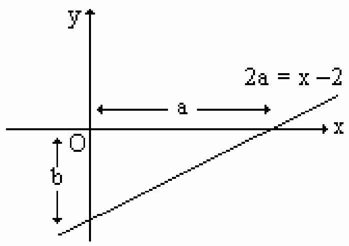
XYZ SECONDARY SCHOOL

Name: _________________ (   )   Date: ____________
Time allowed: min
Class: _______   Marks: $\frac{}{5}$

Secondary 2 Multiple-Choice Questions
Chapter 8 Graphs of Linear Equations in Two Unknowns

1. The quadrilateral whose vertices are the points A (0, 3), B (3, -2), C (8,1) and D(5,6) is a
   (A) parallelogram   (B) rhombus   (C) rectangle
   (D) square   (E) kite   (   )

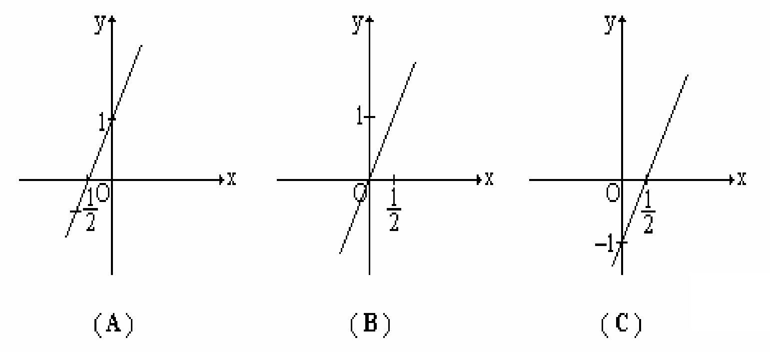
2. The diagram shows the graph of $2y = x - 2$. The values of a and b are respectively
   (A) 1 and -2   (B) 2 and -1
   (C) 2 and 1   (D) -2 and -1
   (E) -1 and 2

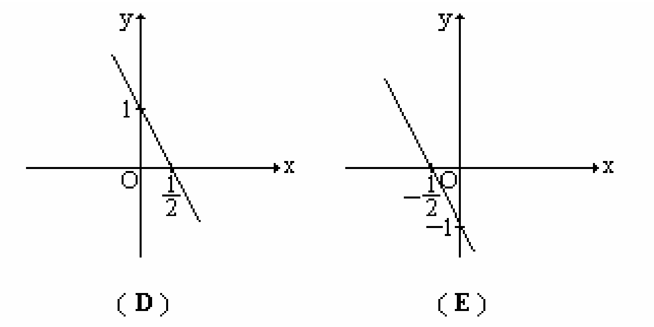


(   )

3. The graphs of $x - 2y - 3 = 0$ and $6 + 4y - 2x = 0$
   (A) are identical   (B) are parallel   (C) are perpendicular
   (D) intersect at one point   (E) intersect at more that one point
   (   )

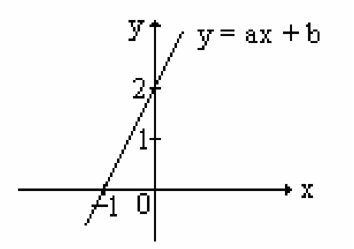
4. Which of the following is the graph of y = -2x - 1?





( )

5. The diagram shows the graph of y = ax + b. Find the values of a and b.



(A) a = 2, b = 2
(B) a = 1, b = 2
(C) a = -2, b = -2
(D) a = -2, b = -1
(E) a = -2, b = 2 ( )

Answers

1. D   2. B   3. A   4. D   5. A

XYZ SECONDARY SCHOOL

Name: ________________ (   )   Date: ____________

Time allowed: min

Class: _______   Marks:

Secondary 2 Mathematics Test

Chapter 8 Graphs of Linear Equations in Two Unknowns

1. Write down three equations representing straight lines parallel to the:
   (a) x–axis [3] (b) y–axis [3]
   (c) line $y = 3x$ [3] (d) line $y = -x + 2$ [3]

2. Draw the graph of each of the following equations:
   (a) $y + 3x = 1$ [3] (b) $2y - x = 5$ [3]
   (c) $2x - \frac{y}{3} = 4$ [3] (d) $\frac{y}{5} - \frac{x}{2} = 1$ [3]

3. Solve the following pairs of equations graphically and verify your solutions:
   (a) $5x - 2y = 0$
   $4x + y = 13$ [4]
   (b) $5y = 6x - 3$
   $2y = x - 4$ [4]
   (c) $y = x + 3$
   $5y + 6x = 15$ [4]
   (d) $\frac{1}{3}x + \frac{1}{3}y = 1$
   $\frac{1}{2}y = 1 - x$ [4]

4. (a) Explain why the simultaneous equations $8x - 4y = 20$ and $y = 2x - 3$ have no solution . What can you say about the straight lines representing these two equations? [3]
   (b) Explain why the simultaneous equations $y = -\frac{2}{3}x + \frac{4}{3}$ and $12x + 18y = 24$ have an infinite number of solutions. What can you say about the two straight lines representing the equations? [3]

5. Draw the graph of each of the following equations on the same graph paper.
   (a) $y + 2x = 10$ [3] (b) $y = x + 4$ [3]
   (c) $4y = x + 28$ [3] (d) $y - x = 2$ [3]

   What figure is formed by these four lines? Write down the coordinates of the vertices of this figure. [2]

6. Find the value of x graphically such that the three points $A(-1, 1)$, $B(3, 7)$ and $C(x, -2)$ lie on the same straight line. [5]

7. Draw the graph of each of the following equations on the same graph paper.
(a) $y = 2$ [2] (b) $x = y$ [2] (c) $y = -2x$ [2]
(i) What figure is formed by these three lines? Write down the coordinates of the vertices of this figure. [4]
(ii) Hence find the area enclosed by these three lines. [3]

8. (a) Using the same scales and axes, draw the following straight lines: $y = 2$, $3y = 2x$, $y = 8 - x$. [3]
(b) From your graph, write down the coordinates of the points of intersection of the three lines. [2]
(c) Find the area of the triangle bound by the three lines. [3]

9. On separate diagrams, draw the graphs of the following equations and state the gradient of each line.
(a) $y = 6x$ [3] (b) $3y = 9x + 5$ [3] (c) $y = 8 - 5x$ [3]
(d) $y = 2(x + 3)$ [3] (e) $2y = 1 - 3x$ [3] (f) $4y = 3 - 4x$ [3]

10. (a) Given the equations $x + 2y = 4$ and $x - 2y = -8$, copy and complete the following tables:

$x + 2y = 4$

x	–4	0	4
y			

$x - 2y = -8$

x	–4	0	4
y			

[2]

(b) Draw the graphs of the equations $x + 2y = 4$ and $x - 2y = -8$ using the same set of axes. [3]
(c) Write down the co-ordinates of the point of intersection of the two graphs. [1]
(d) What can we deduce from the answer to (c)? [1]

11. Solve the simultaneous equations $y = 2x - 5$ and $y = -2x + 3$ using the graphical method. [5]

12. (a) Complete the following tables:

$3x + 2y = 6$

x	0		4
y		0	

$x - y = 7$

x	3	5	7
y			

[2]

(b) Draw the lines representing the given equations in the same co-ordinate plane. [3]

(c) Write down the co-ordinates of the point of intersection of the two lines. [1]

(d) Hence, solve the simultaneous equations $3x + 2y = 6$ and $x - y = 7$. [1]

13. (a) Complete the following tables:

$2x + y = 3$

x	0	1	2
y			

$y = 2x + 1$

x	–1	0	1
y			

[2]

(b) Draw the lines representing the given equations in the same co-ordinate plane. [3]

(c) Write down the co-ordinates of the point of intersection of the two lines. [1]

(d) Hence, solve the simultaneous equations $2x + y = 3$ and $y = 2x + 1$. [1]

14. (a) Using a scale of 1 cm to 1 unit on both axes, draw the graphs of $2x - 3y = 9$ and $x - 2y = 1$ for $-1 \le x \le 16$ in the same co-ordinate plane. [4]

(b) Hence solve the simultaneous equations $2x - 3y = 9$ and $x - 2y = 1$. [1]

15. (a) Using a scale of 2 cm to 1 unit on both axes, draw the graphs of $y = 2x$ and $2x + y + 4 = 0$ for $-4 \le x \le 2$ in the same co-ordinate plane. [4]

(b) Hence solve the simultaneous equations $y = 2x$ and $2x + y + 4 = 0$. [1]

16. (a) Using a scale of 2 cm to 1 unit on the x-axis and 1 cm to 1 unit on the y-axis, draw the graphs of $2x + y = 3$ and $y = 2x + 1$ for $-1 \le x \le 4$ in the same diagram. [4]

(b) Hence solve the simultaneous equations $2x + y = 3$ and $y = 2x + 1$. [1]

17. Solve the simultaneous equations $x - y = 2$ and $x + y = 8$ graphically. [5]

18. Solve the simultaneous equations $3x - 2y = 8$ and $4x + y = 7$ using the graphical method. [5]

19. By drawing the graphs of $11x + 3y + 7 = 0$ and $2x + 5y - 21 = 0$ in the same diagram, solve the simultaneous equations $11x + 3y + 7 = 0$ and $2x + 5y = 21$. [5]

20. By drawing the graphs of $7x + 3y = 15$ and $2y = 5x - 19$ using the same set of axes, solve the simultaneous equations $7x + 3y = 15$ and $2y = 5x - 19$. [5]

Answers

1. (a) $y = m$, any constant. (b) $x = n$, any constant.
(c) $y = 2x + c$ (c = constant). (d) $2y + x = k$, any constant.

3. (a) $x = 2, \quad y = 5$ (b) $x = -2, y = -3$
(c) $x = 0, \quad y = 3$ (d) $x = -1, y = 4$

4. (a) They are parallel. (b) They are identical.

5. Trapezium; (2, 6), (4, 8), (4, 2), (12, 10)

6. −3

7. (i) Triangle; (0, 0), (2, 2), (-1, 2) (ii) 3 unit^2

8. (b) (3, 2), $(4\frac{4}{5}, 3\frac{1}{5})$, (6, 2) (c) $1\frac{4}{5}$ unit^2

9. (a) 6 (b) 3 (c) −5 (d) 2 (e) $-\frac{3}{2}$ (f) -1

10. (a) 4, 2, 0; 2, 4, 6

(c) (-2, 3)

(d) The coordinates of the point of intersection show the solution of the simultaneous equations $x + 2y = 4$ and $x - 2y = -8$

11. (2, -1)

12. (a) 3, 2, -3; -4, 2,0
(b) (4, -3)
(c) $x = 4, y = -3$

13. (a) 3,1, –1; 1, 3

(c) (½, 2)

(d) $x = ½, y = 2$

14. (b) $x = 15, y = 7$

15. (b) $x = -1, y = -2$

16. (b) $x = ½, y = 2$

17. $x = 5, y = 3$

18. $x = 2, y = -1$

19. $x = 2, y = 5$

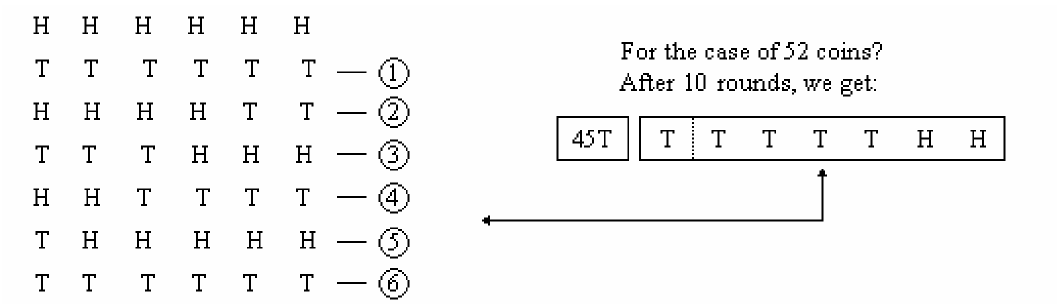
20. $x = 3, y = -2$

Chapter 9

Secondary 2 Mathematics
Chapter 9 Graphs of Quadratic Functions

ANSWERS FOR ENRICHMENT ACTIVITIES

Just For Fun (pg 263)



Six rounds are required for 6 coins and only 12 rounds are needed for 52 coins. For the latter, turn 5 coins at a time to get 50 tails with 2 heads and the situation will end like (4) which only require 2 extra turns.

Just For Fun (pg 264)

(Assume that all cans are filled up to the brim.)

Fill the 5-litre can using the 12–litre can. Pour all 5 litres into the 9-litre can. Fill up the 5-litre can from the 12-litre can again. Then fill up the 9-litre can, leaving 1 litre in the 5-litre can.

Pour the contents of the 9-litre can back into the 12 litre can. Then, pour the 1 litre of water from the 5-litre can into the 9-litre can. Fill up the 5-litre can and pour the contents into the 9-litre can.

Hence, there is 6 litres of water in the 9-litre can with 6 litres left in the 12–litre can.

Secondary 2 Mathematics
Chapter 9 Graphs of Quadratic Functions

GENERAL NOTES

It is advantageous to teach students to recognize quadratic functions and the general shape of their graphs. Students will then be able to detect whether their graphs are out of shape and can rectify them.

To more enterprising students, teachers may want to introduce simple transformations of graphs. Teachers can show their students that

(i) by reflecting the graph of y = x^2 in the x – axis, the graph of y = $-x^2$ is obtained.

(ii) the graph of $y = x^2 + 1$ is obtained by translating the graph of $y = x^2$ UP1 unit parallel to the x–axis and the graph of $y = x^2 - 1$ is the result of the translation of the graph of $y = x^2$ DOWN 1 unit parallel to the x–axis.

(iii) the graph of $y = (x - 1)^2$ is the result of translating the graph of $y = x^2$ (1 unit to the RIGHT) parallel to the y–axis and translating the graph of $y = x^2$ (1 unit to the LEFT) parallel to the y–axis. Hence, we obtain the graph of $y = (x + 1)^2$.

Challenge your students to state the relationship between the graph of y =x^2 and the graphs of each of the following:

(1) $y = x^2 + 1$

(2) $y = x^2 - 1$

(3) $y = -(x - 1)^2$

(4) $y = -(x + 10)^2$

XYZ SECONDARY SCHOOL

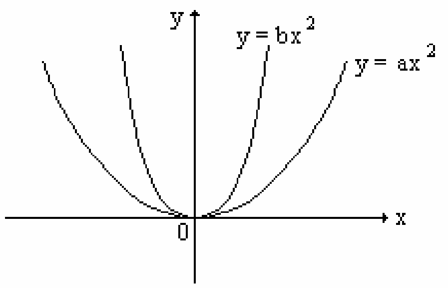
Name: _________________ (   )   Date: ____________
Time allowed: min
Class: _______   Marks: /9

Secondary 2 Multiple-Choice Questions
Chapter 9 Graphs of Quadratic Functions

1. The following table gives the values of $y = ax^2 + bx + c$ for values of x between -2 and 5.
   The smallest value of y is
   (A) -9   (B) 5   (C) between -7 and -9
   (D) between -9 and -10   (E) not defined   (   )

x	−2	−1	0	1	2	3	4	5
y	3	−3	−7	−9	−9	−7	−3	3

2. The diagram shows the graphs of $y = ax^2$ and $y = bx^2$.
   Which of the following is correct?

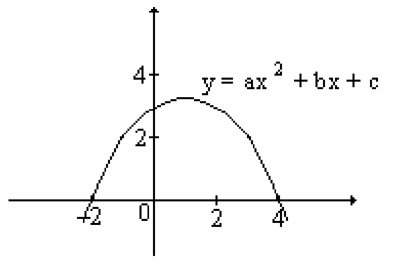


(A) a>0, b>0, a>b   (B) a<0, b<0, a<b   (C) a>0, b>0, a<b
(D) a>0, b<0, a>b   (E) a<0, b>0, a<b
(   )

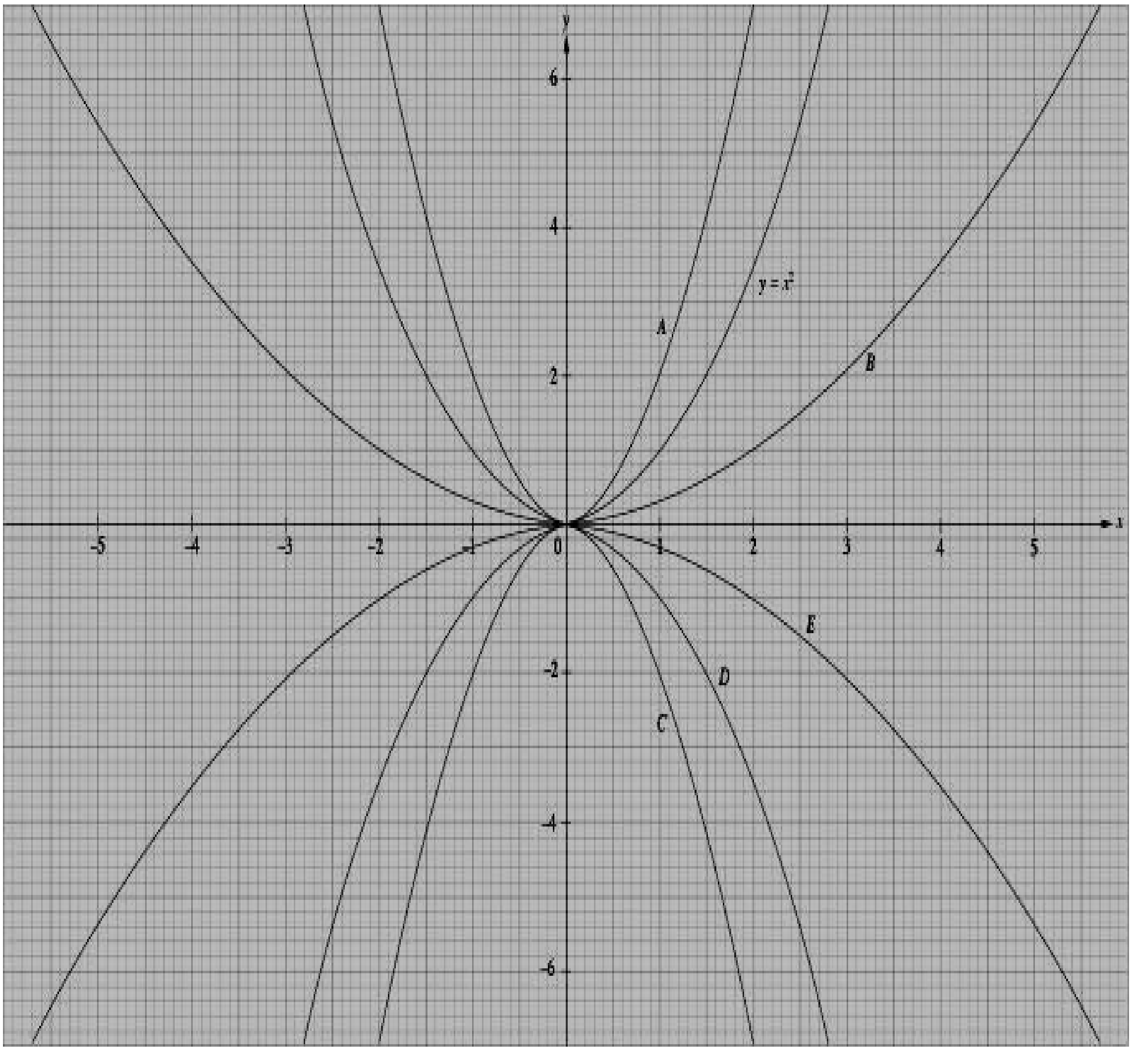
3. The diagram on the right shows the graph of $y = ax^2 + bx + c$. The value of c is

(A) 3 (B) 2 (C) 0

(D) -3 (E) -2 ( )



Answer Question 4 and 5 based on the graph below.



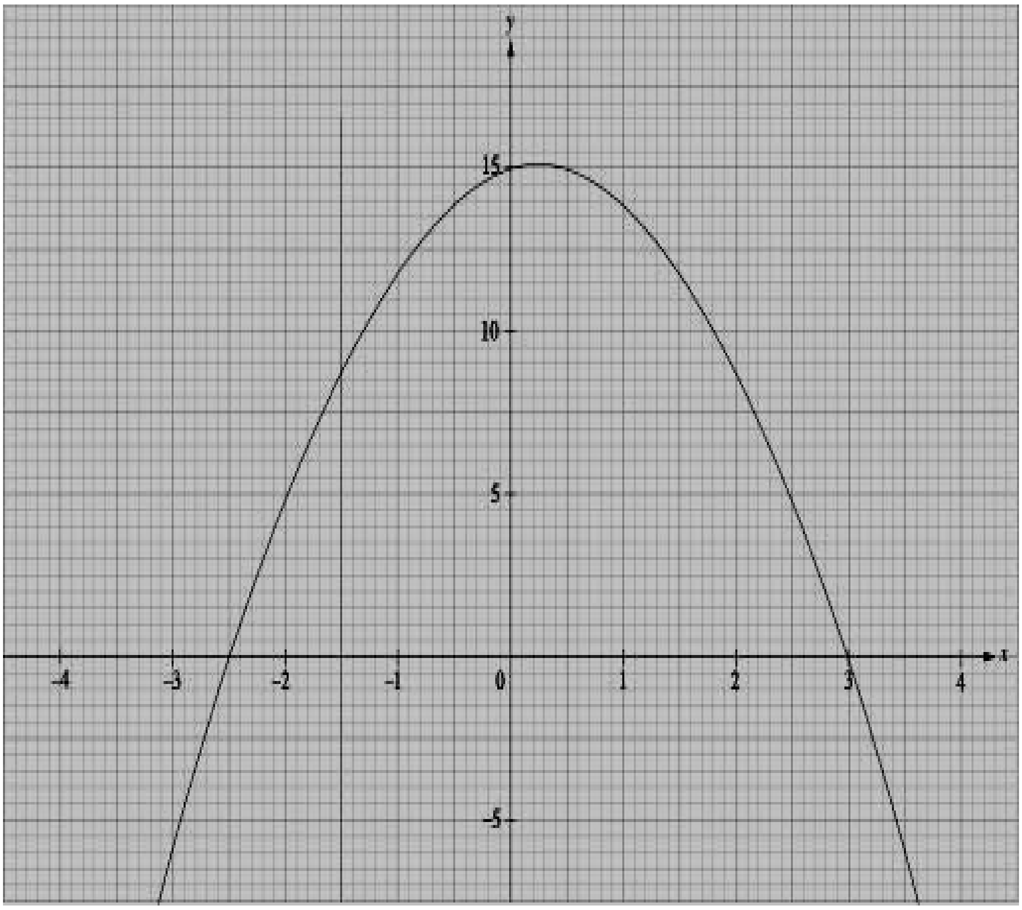
4. The diagram shows 6 graphs, one of which is $y = x^2$. Which of the above could represent the graph of $y = -\frac{1}{4}x^2$?

(A) A (B) B (C) C (D) D (E) E ( )

5. Which of the above could represent the graph of $y = 2x^2$?

(A) A (B) B (C) C (D) D (E) E ( )

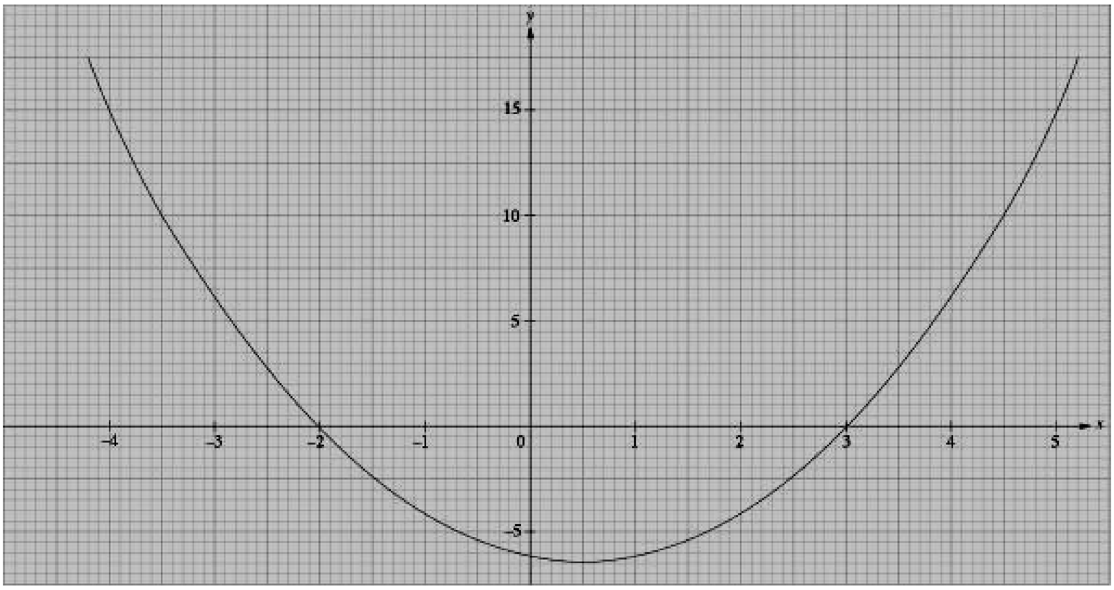
6.



In the graph above, when $y = 5$, the corresponding integer value is

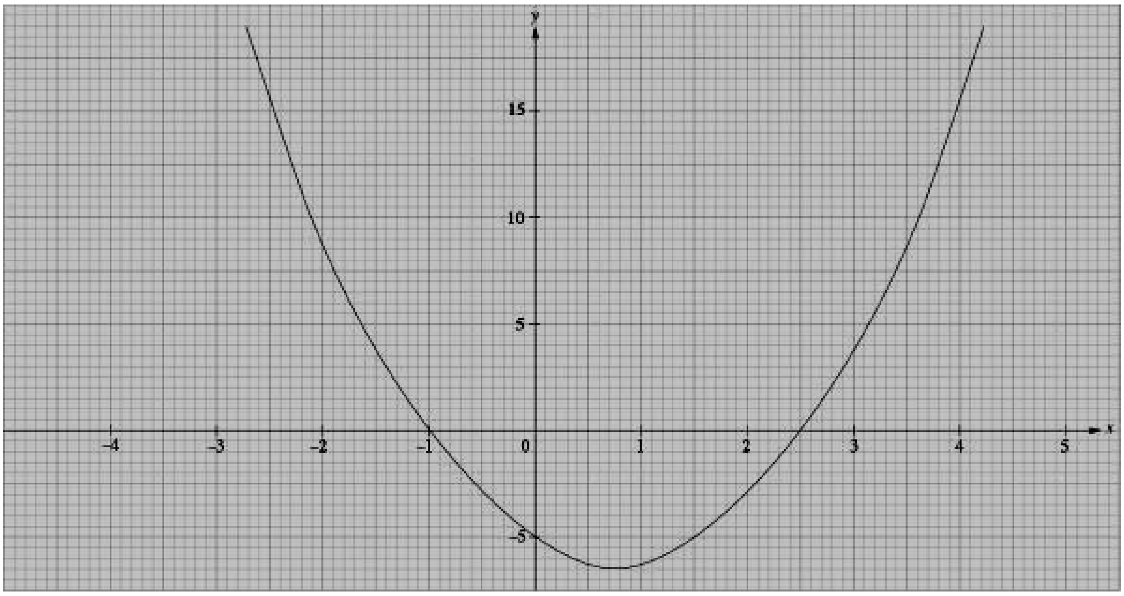
(A) -1 (B) -2 (C) $2\frac{1}{2}$ (D) $-2\frac{1}{2}$ (E) 2 ( )

7. Which of the following quadratic function could represent the graph below?



(A) $y = x^2 + x - 6$ (B) $y = x^2 - x - 6$
(C) $y = 2x^2 - x - 6$ (D) $y = 6 + x - x^2$
(E) $y = 2x^2 + x - 6$ ( )

8.



In the diagram above, when $x = 1.5$, the value of y is

(A) 5 (B) -5 (C) 0 (D) 4 (E) -3 ( )

9. The table below gives corresponding values of x and y for the function $y = 2x^2 + 5x - 3$. If p and q are integers, calculate the value of $2p - q$.

x	-1	1	3	p
y	-6	q	30	99

(A) 8 (B) 10 (C) 2 (D) -2 (E) 0 ( )

Answers

1. D 2. C 3. A 4. E 5. A 6. B 7. B 8. B 9. A

XYZ SECONDARY SCHOOL

Name:_____________________ Date: _______

Time allowed: min

Class:______________ (_______) Marks:

Secondary Two Mathematics Test

Chapter 9 Graphs of Quadratic Functions

1. Copy and complete the following table for $y = 2x^2 + x - 6$.

x	–3	–2	–1	0	1	2	3
y	9		–5		–3		

Using a scale of 2 cm to represent 1 unit on the x-axis and 1 cm to represent 1 unit on the y-axis, draw the graph of $y = 2x^2 + x - 6$ for $-3 \le x \le 3$. Use your graph to find

(a) the value of y when $x = 1.2$,

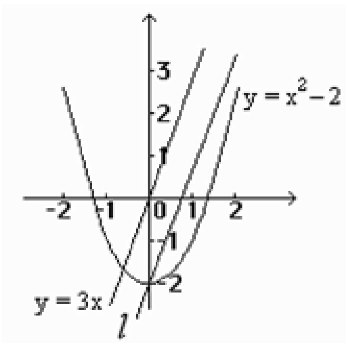
(b) the values of x when $y = 6$. [7]

2. The curve $y = x^2 - 2$ cuts the y-axis at the point P.

(a) Write down the co-ordinates of P. [1]

(b) State the equation of the line of symmetry of the curve. [1]

(c) Find the equation of the line through P, parallel to the line $y = 3x$. [2]



3. The variables u and v are connected by the equation $v = 4 - 2u - u^2$.

(a) Copy and complete the table below for some corresponding values of u and v.

u	–4	–3	–2	–1	0	1	2
v	–4	1				1	

[2]

(b) Taking 2 cm to represent 1 unit on both axes, draw the graph of $v = 4 - 2u - u^2$, for values of u in the range $-4 \le u \le 2$. [2]

(c) Use your graph to find (i) the values of u when $v = 2.5$, [1]

(ii) the maximum value of $4 - 2u - u^2$, [1]

(iii) the equation of the line of symmetry. [1]

(d) On the same axes, draw the graph of $v = u + 1$. [1]

(e) From the graphs, find the solution for $u^2 + 3u - 3 = 0$. [2]

4. Given that $y = 2(x+1)^2 - 7$, complete the following table:

x	–4	–3	–2	–1	0	1	2
y	11			–7			11

[2]

Taking 2 cm to represent 1 unit on the x-axis and 1 cm to represent 1 unit on the y-axis, draw the graph of $y = 2(x+1)^2 - 7$ from $x = -4$ to $x = 2$.

Use your graph to find (a) the value of y when $x = -2.6$, [1]

(b) the values of x when $y = 0$, [1]

(c) the least value of y, [1]

(d) the equation of the line of symmetry of the curve drawn. [1]

5. Complete the table of values for the quadratic function $y = \frac{1}{5}(12x - x^2)$.

x	0	2	4	6	8	10	12	14
y	0		6.4			4	0	

[2]

Taking 1 cm to represent 1 unit on each axis, draw the graph of $y = \frac{1}{5}(12x - x^2)$ for the values of x in the range of $0 \le x \le 14$.

Use the graph to (a) find the values of x when $y = 5$, [1]

(b) find the value of y when $x = 11$, [1]

(c) find the solution for $-x^2 + 6x - 5 = 0$ by drawing the line of $y = \frac{6}{5}x + 1$. [2]

6. The following is an incomplete table of values for the graph of $y = 3 + 13x - 4x^2$.

x	–2	–1	0	1	2	3	4	5
y	–39		3			6	–9	

(a) Calculate the missing values of y. [2]

(b) Using a scale of 2 cm to 1 unit on the x-axis and 2 cm to 10 units on the y-axis, draw the graph of $y = 3 + 13x - 4x^2$. [2]

Use your graph to find

(c) (i) the values of x when $y = 0$, [1]

(ii) the value of y when $x = -\frac{1}{2}$, [1]

(iii) the equation of the line of symmetry of the curve, [1]

(iv) the solution for $-4x^2 + 9x + 12 = 0$ by drawing the line of $y = 4x - 9$. [2]

7. The following table shows the values for the graph $y = 5 + 3x - 2x^2$.

x	–2	–1	0	$\frac{1}{2}$	1	2	3
y	–9	a	5	b	c	3	d

(a) Calculate the values of a, b, c and d. [2]

(b) Taking 2 cm to represent 1 unit on the x-axis and 1 cm to represent 1 unit on the y-axis, draw the graph of $y = 5 + 3x - 2x^2$ for values of x from –2 to 3. [3]

(c) Use your graph to

(i) solve the equation $5 + 3x - 2x^2 = 0$, [2]

(ii) find the greatest value of $5 + 3x - 2x^2$. [1]

8. Copy and complete the table of values given below for the curve $y = (x + 1)(x - \frac{7}{2})$.

x	–2	–1	0	1	2	3	4
y	5.5		–3.5			–2	2.5

[2]

(a) Using a scale of 2 cm to 1 unit on the x-axis and 1 cm to 1 unit on the y-axis, draw the graph of $y = (x + 1)(x - \frac{7}{2})$ for values of x from –2 to 4. [3]

(b) Use your graph to find (i) the value of x when $y = -3$, [1]

(ii) the least value of $(x + 1)(x - \frac{7}{2})$. [1]

(c) On the same graph and using the same scale, draw the graph of $2y = 3x - 4$ for values of x from –2 to 4. [2]

(d) Using both graphs drawn, find the values of x at the points where the graph of $y = (x + 1)(x - \frac{7}{2})$ intersects the graph of $4y = 3x - 2$. [2]

9. Copy and complete the table of values given below for the curve $y = 24 + 3x - 2x^2$.

x	–3	–2	–1	0	1	2	3	4	5
y	–3	10						4	–11

[2]

Using a scale of 2 cm to 1 unit on the x-axis and 2 cm to 10 units on the y-axis, draw the graph of $y = 24 + 3x - 2x^2$ for values of x from –3 to 5. [3]

From your graph, find the values of x satisfying the equation $24 + 3x - 2x^2 = 13$. [2]

10. (a) Given that $y = 3x^2 - 4x - 30$, copy and complete the following table: [2]

x	–3	–2	–1	0	1	2	3	4	5
y	9	–10		–30	–31			2	

(b) Taking 2 cm to represent 1 unit on the x-axis and 2 cm to represent 10 units on the y-axis, draw the graph of $y = 3x^2 - 4x - 30$, for values of x in the range $-3 \leq x \leq 5$. [3]

(c) Use your graph to estimate the two values of x which satisfy the equation $30 + 4x - 3x^2 = 0$. [2]

(d) Using the same axes and scales, draw the graph of $y - 2x = 10$ and hence estimate the two values of x which satisfy the equation $3x^2 - 6x - 40 = 0$. [3]

11. Copy and complete the following table of values for $y = x^2 - 4x + 1$ for values of x from 0 to 3.

x	0	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	4
y	1.0	–0.75					–2.0	1.0

[2]

Plot the graph of $y = x^2 - 4x + 1$ using a scale of 4 cm to 1 unit for both axes for $0 \leq x \leq 3$. [2]

Use your graph to find

(a) the value of x for which y has the least value, [1]

(b) the value of y when $x = 1.7$, [1]

(c) the value of x when $y = 0$. [1]

12. (a) Given that $y = x^2 - 6x$, copy and complete the following table:

x	–1	0	1	2	3	4	5	6	7
y		0		–8		–8		0	7

[2]

(b) Taking 2 cm to represent 1 unit on the x-axis and 1 cm to represent 1 unit on the y-axis, draw the graph of $y = x^2 - 6x$ from $x = -1$ to $x = 7$. [3]

(c) From your graph, find

(i) the values of x when $y = -4$, [1]

(ii) the equation of the line of symmetry of $y = x^2 - 6x$, [1]

(iii) the least value of $x^2 - 6x$. [1]

13. The following is a table of values for the equation $y = 2x + \frac{x^2}{2}$. Copy and complete it.

x	–5	–4	–3	–2	–1	0	1	2	3
y		0			–1.5	0	2.5		10.5

[2]

Using a scale of 2 cm to 1 unit on the x-axis and a scale of 1 cm to 1 unit on the y-axis, draw the graph of $y = 2x + \frac{x^2}{2}$. [3]

From your graph, find

(a) the value of y when $x = –0.6$, [1]

(b) the least value of $2x + \frac{x^2}{2}$, [1]

(c) the values of x when $y = 2$. [1]

14. (a) Given that $y = 3 – 4x – 4x^2$, copy and complete the following table:

x	$-2\frac{1}{2}$	–2	$-1\frac{1}{2}$	–1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1	$1\frac{1}{2}$	2
y	–12		0	3		3	0	–5		

[2]

(b) Using a scale of 2 cm to 1 unit on the x-axis and 2 cm to 5 units on the y-axis, plot the graph of $y = 3 – 4x – 4x^2$ for the range $-2\frac{1}{2} \le x \le 2$. [3]

(c) From your graph, find

(i) the greatest value of y, [1]

(ii) the values of x when $y = –10$. [1]

15. The table below shows the values for $y = x^2 – 6x + 11$.

x	1	2	$\frac{5}{2}$	3	$\frac{7}{2}$	4	5
y	a	3	b	c	$2\frac{1}{4}$	d	6

(a) Find the values of a, b, c and d. [2]

(b) Taking 2 cm to represent 1 unit on each axis, draw the graph of

$y = x^2 – 6x + 11$ for $1 \le x \le 5$. [3]

(c) From your graph, find the values of x when $y = 4$. [1]

(d) Using the same axes and scales, draw the graph of $x + y = 5$ and hence find the solution of the equation . [3]

16. The variables x and y are connected by the equation $y = 2x^2 - 15x + 25$ and some corresponding values are given in the following table:

x	0	1	2	3	4	5	6	7
y	25	12	3	–2	a	0	b	18

(a) Calculate the values of a and b. [1]

(b) Taking 2 cm to represent 1 unit on the x-axis and 2 cm to represent 5 units on the y-axis, draw the graph of $y = 2x^2 - 15x + 25$ for the values of x from 0 to 7. [3]

(c) Using the following table of values satisfying $y = 2x$-3, draw the graph of the line $y = 2x - 3$ on the same axes. [1]

x	0	4	6
y	–3	5	9

(d) From the graph, find the x-coordinate of the points of intersection of the curve $y = 2x^2 - 15x + 25$ and the line $y = 2x - 3$. [2]

17. The following is an incomplete table of values for the graph of

x	0	20	40	60	80	100	120	140	160	180	200	220	240
y	0	2 200		5 400	6 400	7 000		7 000	6 400	5 400		2 200	

(a) Calculate the missing values of y. [2]

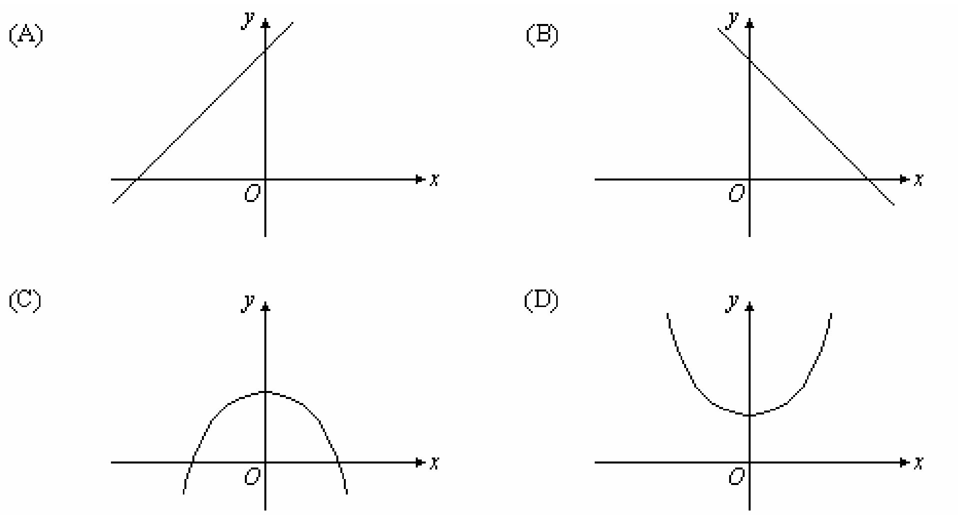
(b) Taking a scale of 2 cm to 40 units on the x-axis and 2 cm to 1 000 units on the y-axis, draw the graph of $y = 120x - \frac{1}{2}x^2$ for the range $0 \le x \le 240$. [3]

(c) From your graph, find (i) the value of y when x=44, [1]

(ii) the values of x when y = 3 000, [2]

(iii) the greatest value of y. [1]

18. Below are 4 graphs and 4 equations. Match each graph to the most appropriate equation.



19. Copy and complete the following table for the equation $y = x^2 - 2x + 3$.

x	−1	0	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	3
y							

(a) Draw the graph of the equation, indicating the axis of symmetry.

(b) Use your graph to find the values of x when y = 4 and $2\frac{1}{2}$.

20. Copy and complete the following table for the equation $y=x^2-x+1$.

x	$-1\frac{1}{2}$	−1	0	1	2	$2\frac{1}{2}$
y						

(a) Draw the graph of the equation, indicating the line of symmetry of the graph.
(b) Draw a tangent to touch the graph at x = 2 and find the x–coordinate of the Point of intersection of this tangent and the x–axis.
(c) Use your graph to solve the equation $x^2 - x + 1 = 2$.
(d) Add the line joining the points (–1, 0) and (1,2) to your diagram and find the x–coordinates of the points at which the line cuts the graph.

21. The area, y cm² and the circumference, x cm of a circle are connected by the equation $y = \frac{1}{4\pi}x^2$. Corresponding values of x and y are given below.

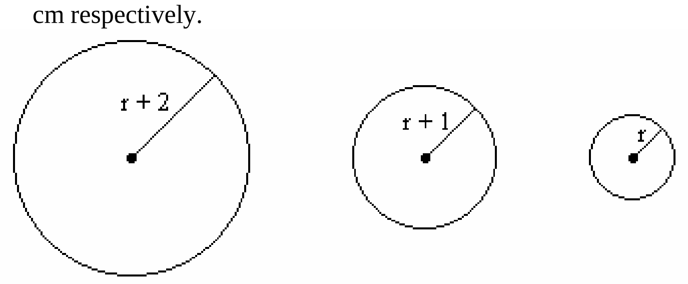
x	0	1	2	3	4	5	6	7
y	0	0·1	0·3	0·7	1·3	2·0	2·9	3·9

(a) Using a scale of 2 cm to 1 unit on the x–axis and 4 cm to 1 unit on the y–axis, draw the graph of $y = \frac{1}{4\pi}x^2$ for values of x in the range $0 \le x \le 7$.

(b) Use your graph to find
(i) the circumference of the circle whose area is 2.5 cm²,
(ii) the area of the circle whose circumference is 3.2 cm .

(a) Choose a pair of values of x and y to estimate the value of πto 2 significant figures.

22. The diagrams below show three circles of radii (r + 2) cm, (r + 1) cm and r cm respectively.



(a) (i) Find the total area of the three circles terms of r and π.

(ii) If the total area of the three circles is π y cm², show that $y = 3r^2 + 6r + 5$.

(b) Corresponding values of r and y are given below.

r	0	1	2	3	4	5	6
y	5		29	50	77	110	

(i) Calculate, and write down, the value of y when r = 1 cm, and when r = 6 cm.

(ii) Using a scale of 2 cm to 1 unit on the r–axis and 1cm to 10 units on the y-axis, draw the graph of $y = 3r^2 + 6r + 5$, for values of r in the range $1 \le r \le 6$.

(c) Use your graph to find

(i) the value of r when the total area of the three circles is 264 cm^2 and take π to be $\frac{22}{7}$.

(ii) the total area of the three circles when r = 3.1 cm , giving your answers correct to the nearest cm². (Take π to be 3.142.)

Answers

1.
Ans: (a) $y = -1.9$
(b) x = –2.7 or 2.2

2.
Ans: (a) (0, -2)
(b) $x = 0$
(c) $y = 3x - 2$

3.
Ans: (a) 4, 5, 4, –4
(c) (I) –2.6, 0.6 (ii) 5 (iii) $x = -1$
(e) – 3.8, 0.8

4.
Ans:
1, 5 –5, 5, 1
(b) –2.9 or 0.9
(c) –7
(d) $x = -1$

5.
Ans: (a) 2.7, 9.3
(b) 2.2
(c) $x = 1$, 4, 7.2 or $x = 5$, 6.4, - 5.6

6.
Ans: (a) – 14, 12, 13, – 31
(c) (i) – 0.2, 3.5 (ii) – 4.5 (iii) $x = 1.6$ (iv) $x = -0.9$ or 3.2

7.
Ans: (a) $a = 0$, $b = 6$, $c = 6$, $d = -4$
(c) (i) $x = -1$ or 2.5 (ii) 6.1

8.
Ans: 0, -5, -4.5
(b) (I) x = - 0.2 or 2.7 (ii) – 5.1
(d) – 0.9, 3.7

9.
Ans: 19, 24, 25, 22, 15 ; - 1.7 or 3.2

10.
Ans: (a) –23, -26, -15, 25
(c) – 2.6 or 3.9
(d) – 2.8 or 4.8

11.
Ans: - 2.0, - 2.75, - 3.0, 2.75
(a) 2
(b) – 2.9
(c) 0.3 or 3.7

12.
Ans: (a) 7, -5, -9, -5
(c) (I) 0.8 or 5.2 (ii) $x = 3$ (iii) – 9

13.
Ans: 2.5, - 1.5, - 2.6
(a) – 1.0 (b) – 2 (c) – 4.8, 0.8

14.
Ans: (a) –5, 4, - 12, - 21
(c) (i) 4 (ii) – 2.4 or 1.4

15.
Ans: (a) $a = 6$, $b = 2\frac{1}{4}$, $c = 2$ d) $d = 3$
(c) 1.6 or 4.4
(d) $x = 2$ or 3

16.
Ans: (a) a = -3, b = 7
(d) 2.2 and 6.3

17.
Ans: (a) 4 000, 7 200, 4 000, 0
(c) (i) 4 300 (ii) 28 or 212 (iii) 7 200

18. (a) (C) (b) (A) (c) (D) (d) (B)

19. (a) 6, 3, $2\frac{1}{4}$, 2, $2\frac{1}{4}$, 3, 6 (b) -0.4, 2.4, 0.3, 1.7

20. $1\frac{3}{4}$, 3, 1, 1, 3, $4\frac{3}{4}$ (b) x = 1 (c) –0.6, 1.6 (d) 0, 2

21. (b) (I) 5.6cm (ii) 0.8cm² (c) 3. 1

22. (a) (I) $\pi(3r^2 + 6r + 5)$ (b) (i) 14,149 (c) (I) 4.2 (ii) 163cm²

Chapter 10

Secondary 2 Mathematics
Chapter 10 Set Language and Notation

ANSWERS FOR ENRICHMENT ACTIVITIES

Just For Fun (pg 296)
The main technique is to make an assumption.

From (2) we know that Adam speaks German. Assuming that Adam also speaks Chinese, we can deduce the rest of the conditions to get the answer. If this doesn't work, we make another assumption, say Adam speaks English etc. Do you get the answer that:

Adam speaks German and Chinese.
Bob speaks Chinese and French.
Charles speaks English and French.
David speaks Chinese and English.

Just For Fun (pg 302)

1. Divide the coins into sets A, B and C of 3 coins each. Place sets A and B on the balance. If they balance, the lighter coin must be in set C. Put two of the coins from set C on the balance, if they balance, the lighter coin must be the other remaining coin, otherwise the result is obvious. If set A and B do not balance, take the coins from the lighter side and do a second weighing as for set C to determine the lighter coin.

2. The other is the 5-cents coin. The values of the two coins are 5 cents and 20 cents.

Secondary 2 Mathematics
Chapter 10 Set Language and Notation

GENERAL NOTES

There are many opportunities to infuse National Education in this chapter. For example the chapter's introduction on Singapore's National Day commemorative stamps is an ideal opportunity to ask pupils what does being a Singaporean mean to them: What is it that they like about the country, what are the areas that the country can improve on, what steps each Singaporean can do to help to bring about changes to make this place a better place to live, work and bring up a family, what they as pupils can do to help to bring about the change, etc. The teacher can ask pupils what are their views on the setting up of the two Integrated Resorts (IR) in Singapore by the government and the introduction of Night Formula One race in 2008. Besides these broad schemes that Singapore is embarking on, teachers could also touch on other areas closer to their heart that will help to bring about the consciousness of the situations in Singapore.

When teaching the idea of Null set, the teacher can ask pupils to give other examples of null sets and one may be surprised by the many interesting null sets that the pupils can think of. Have fun with this. Examples such as:

the set of beggars in Singapore who own a fleet of Mercedes cars,
the set of high jumpers who had cleared a height of 3 metres,
the set of Singaporean females who had reached the South Pole,
the set of Singaporeans who had signed up as space travellers.

For this you can talk about the quest of a team of four male Singaporeans who had reached the South Pole at the turn of the millennium. Alternatively, pupils could talk about another team of Singaporeans, which included one female member, who conquered Mount Vinson Massif in the South Pole at the beginning of January 2000.

NE MESSAGES

Singapore is our homeland; this is where we belong.

Exploration activity on page 290 Activity B
We can turn activity B into an NE lesson by focusing on the festivals and religious ceremonies of the various racial and religious groups into a lesson on understanding of the racial and religious sensitivities of the different ethnic groups in Singapore.

XYZ SECONDARY SCHOOL

Name: _________________ ( ) Date: ____________

Time allowed: min

Class: _______ Marks: $\frac{\quad}{8}$

Secondary 2 Multiple-Choice Questions
Chapter 10 Set Language and Notation

1. If A and B are any sets, $A \cap B \neq \varnothing$ may imply that

(A) $A = \varnothing$ (B) $A \cup B = \mathcal{E}$ (C) $B' \cap A = B'$
(D) $(A \cap B)' = \mathcal{E}$ (E) $B = \varnothing$ ( )

2. Given that $P = \{a, b, c, d, e, f\}$, $Q = \{a, e, i, o, u)$, find the value of $n(P) + n(Q)$.

(A) 11 (B) 9 (C) 2
(D) 7 (E) 1 ( )

3. Given that $B = \{\text{all boys}\} = G'$ and $G = \{\text{all girls}\} = B'$, simplify $(G \cap B') \cap (B' \cap G')$.

(A) B' (B) G' (C) $B \cap G$
(D) $B \cup G$ (E) $\varnothing$ ( )

4. Given that $\mathcal{E} = \{\text{quadrilaterals}\}$, $P = \{\text{rectangles}\}$, $Q = \{\text{parallelograms}]$ and $R = \{\text{rhombuses}\}$, then

(A) $P \cap R = \varnothing$ (B) $Q \subset R$ (C) $P \subset Q$
(D) $R \cup P = Q$ (E) none of the above ( )

5. Which of the following statements are false?

(I) If $A \subseteq B$, then $A' \subseteq B'$.
(II) If A is a subset of B, then $A \cap B = B$.
(III) If A, P and Q are sets, then $A \cap P = A \cap Q \Rightarrow P = Q$.

(A) I and II only (B) I and III only (C) II and III only
(D) I, II and III (E) none of the above ( )

6. Which of the following statements are false?

(I) Every subset of a finite set is finite.
(II) Every subset of an infinite set is infinite.
(III) If a $\in A$ and a $\in B$, then $A = B$.

(A) I and II only (B) I and III only (C) II and III only
(D) I, II and III (E) none of the above ( )

7. Which of the following statements are true?

(I) If $A = \{1, 3, 5, 7\}$ and $B = \{x : x$ is an odd number$\}$, then $A \cap B = A$.
(II) If $A = \{x : x$ is a positive even number$\}$ and $B = \{x : x$ is a prime number$\}$, then $A \cap B = \varnothing$.
(III) If $A = \{x : x$ is a solution of $(x - 1)(x - 3) = 0\}$ and $B = \{x : x$ is a solution of $3x^2 + 4x - 7 = 0\}$, then $A \cup B = \{1, 3, -2\tfrac{1}{3}\}$.

(A) I and II only (B) I and III only (C) II and III only
(D) I, II and III (E) none of the above ( )

8. Given that A and B are sets such that $A \cap B = A$, which of the following statements are true?

(I) A is a subset of B.
(II) $A \cup B = B$.
(III) $A' \cap B' = \varnothing$.

(A) I and II only (B) II and III only (C) I and III only
(D) I, II and III (E) none of the above ( )

Answers

1. C	**2.** A	**3.** A	**4.** C
5. D	**6.** C	**7.** B	**8.** A

XYZ SECONDARY SCHOOL

Name: __________________ (   )   Date: _____________
Time allowed: min
Class: ________   Marks:

Secondary 2 Mathematics Test
Chapter 10   Set Language and Notation

1. Given that A = {a, b,{c}, k, t}, state whether each of the following statements is true(T) or false(F):

(a) a $\in A$ (b) {a} $\subseteq A$ (c) {c} $\in A$ (d) {a, c} $\subseteq A$

(e) {b} $\in A$ (f) {k, t} $\subseteq A$ (g) {{c}, k, t} $\subseteq A$ (h) Ø $\subseteq A$

(i) {{c}} $\in A$ (j) {c} $\subseteq A$ [10]

2. State whether each of the following statements is true(T) or false(F).

(a) {p, q, r} and {a, b, {r}} are disjoint sets.

(b) If $A \subseteq B$ and $B \subseteq A$, then $A = B$.

(c) If $P \cup Q = Q$, then $Q \subseteq P$.

(d) If $A \cap B = A \cup B$, then $A = B$.

(e) If $A \cap B$ = {a}, then a $\in A$ and a $\in B$.

(f) If $A \cup B$ = {a, b, c, d}, then a $\in A$ and a $\in B$.

(g) a $\in$ {a, b, c, d}.

(h) a $\subseteq$ {a, b, c, d}.

(i) If $P \cap Q$ = Ø, the P and Q are disjoint sets. [9]

3. Given that ε = { prime numbers less that 50), $A = \{x : 17 < x \leq 41\}$ and

$B = \{x : 5 < x \leq 29\}$, list the members of the following:

(a) $A \cup B$ (b) $A \cap B$ (c) $A' \cup B$ (d) $A' \cup B'$ [8]

4. Given that $\varepsilon = \{x : x$ is a whole number and $1 \leq x \leq 12)$, $A = \{2, 3, 6, 8, 10\}$,

$A \cap B = \{3, 6, 8\}$ and $A \cup B = (1, 2, 3, 4, 5, 6, 8, 10, 12)$, illustrate the above data on a clearly labelled Venn diagram and list the elements of the set B. [4]

5. ** Given that ε = {1, 2, 3, 4, 5, a, b, c, d, e}, A = {2, 3, 4, b, c, d}, B = {3, 4, e},

C = {1, 3} and D = {1}, find the following:

(a) $(A \cap B) \cup C$ (b) $(C \cup D) \cap A$ (c) $(A' \cap B) \cup D$

(d) $(A \cap B) \cup (C \cap D)$ (e) $(A' \cup B) \cap (C' \cap D')$ (f) $(A \cap B \cap C) \cup D$ [6]

6. ** Given that $\varepsilon = \{x : x$ is an integer, $12 \leq x \leq 39\}$, $A = \{x : x$ is a multiple of $5\}$,

$B = \{x : x$ is a perfect square$\}$ and $C = (x : x$ is odd$)$, list the members of each of the following:

(a) $A \cap B$ (b) $A \cap C$

(c) $B \cup C$ (d) $(B \cap C) \cup (A \cap B')$ [8]

7. Given that the universal set is the set of integers, $A = \{x : x > 4\}$, $B = \{x : -1 < x \leq 10\}$ and $C = \{ x : x < 8\}$, use similar set notation to describe each of the following:

(a) $A \cap B$ (b) $B \cap C$ (c) $A' \cap B$ (d) $A' \cap C$ [4]

8. Fill in the blanks with the symbol $\in$, $\notin$, $=$, $\subseteq$ or $\supseteq$ so as to make the following statements correct:

(a) {3, 5}_____ {3, 7, 5, 9}

(b) {2, 5, 6}_____ {6, 5, 2, 6}

(c) {3, 6, 9, 12}_____ {multiples of 3}

(d) {5, 6, 7, 8}_____ $\{x : x$ is an integer, $4 \le x < 9\}$

(e) $\{x : 1 \le x \le 9\}$_____ $\{x : 2 < x \le 8\}$

(f) go_____ {go, goh, gosh}

(g) god_____ {g, o, d, go}

(h) {2, 3, 5, 7}_____ {prime numbers less than 10} [8]

9. Given that $\varepsilon = \{ x: x$ is a whole number and $x \le 20\}$, $A = \{2, 4, 6, 8, 10, 12\}$ and $B = \{1, 4, 9, 16\}$, list the elements of each of the following:

(a) $A \cap B'$ (b) $A' \cap B$ (c) $A' \cap B'$ (d) $A' \cup B'$ [8]

10. Given that $\varepsilon = \{x : x$ is a positive integer and $5 < 3x \le 28\}$, $A = \{x : x$ is a multiple of $3\}$, $B = \{x : x$ is divisible by $2\}$,

(a) find $n(A')$,

(b) list the elements of (i) $(A \cup B)'$, (ii) $(A \cap B')$ [6]

11. A is the set of positive integer pairs (x, y) such that $2x + y \le 7$. Find $n(A)$. [4]

12. (a) If $A \subseteq B$ and $B \subseteq A$, what can yo say about the sets A and B?

(b) The three sets P, Q and R are such that $P \cap Q \neq \emptyset$, $P \cap R = \emptyset$ and $R \subseteq Q$. Draw a clearly labelled Venn diagram to illustrate the above information. [6]

13. Given that ε = { x : x is an integer}, $A = \{x : 20 < x \leq 32\}$ and $B = \{x : 24 \leq x < 37\}$, list the elements of

(a) $A \cap B$, (b) $A \cup B$. [4]

14. Given that ε = {6, 8, 10, 12, 13, 14, 15, 16, 18, 20, 21}, A = {x : x is a multiple of 3} and $B = \{x : 2x - 7 \leq 25\}$, find

(a) $A \cup B$, (b) $n(A \cap B')$. [4]

15. Given that ε = {x : x is a natural number, $2 \leq x \leq 15$}, A = {x : x is a multiple of 3} and B = {x : x is even},

(a) list the elements of $A' \cap B$, (b) find the value of $n(A) - n(A \cap B)$. [5]

****16.** Given that ε = {integers}, A = {factors of 4}, B = {factors of 6}, C = {factors of 12} and D = {factors of 9}, list the elements of each of the following:

(a) $A \cup B$ (b) $B \cap C$ (c) $C \cap D$

(d) $A \cup B \cap C$ (e) $B \cup C \cap D$ (f) $A \cap B \cap C \cap D$ [6]

17. Draw separate Venn diagrams to illustrate each of the following relations between the sets A and B:

(a) $A' \cup B' = B'$ (b) $A \cap B = B$ (c) $A \cap B = \emptyset$ (d) $A' \cap B = \emptyset$ [8]

18. If $\varepsilon = \{ x : x$ is an integer and $0 \leq x \leq 24 \}$, A = $\{x : x$ is a prime number$\}$ and $B = \{x : 14 < 3x + 2 < 37\}$, find

(a) $A \cap B$, (b) the value of n ($A \cap B$). [5]

19. State the number of elements in each of the following sets:

(a) $A = \{$ factors of 12 $\}$

(b) $B = \{$ prime factors of 48$\}$

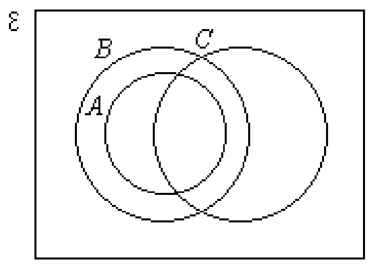
(c) $C = \{ x : x$ is an integer and $3x – 4 = 5 \}$

(d) $D = \{ x : x$ is a positive integer and $3x – 7 < 33 \}$

(e) $E = \{$ a quadrilateral with 5 acute angles $\}$

(f) $F = \{ x : x$ is a positive integer and $x^2 < 50 \}$ [6]

****20.** On separate copies of the given Venn diagram, shade the region represented by each of the following:



(a) $A' \cap B$ (b) $A' \cap B \cap C$

(c) $A \cap B \cap C'$ (d) $B \cap (A \cup C)$ [8]

21. State whether each of the following is true (T) or false (F).

(a) If a $\in A$ and $A \subseteq B$, the a $\in B$.

(b) If $A \subset B$ and $B \subseteq C$, then $A \subseteq C$.

(c) If a $\in A$ and a $\in B$, the $A = B$.

(d) If $\varnothing = A'$, then $A = \varepsilon$.

(e) If A and B are disjoint sets, then $A' \subseteq B'$.

(f) If $\varepsilon = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{2, 5, 7\}$ and $B = \{3, 4, 8, 9\}$, then $B' \subseteq A'$. [6]

22. Given that $n(A) = 12$, $n(B) = 23$ and $n(A \cup B) = 30$, find the value of $n(A \cap B)$. [4]

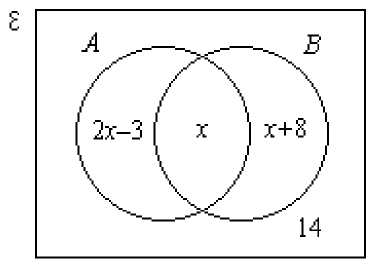
23. Given that $n(A) = 25$, $n(A \cap B) = 7$ and $n(A \cup B) = 38$, find the value of $n(B)$. [4]

24. Given that $n(\varepsilon) = 60$, $n(A \cup B)' = 5$, $n(A') = 35$ and $n(B') = 26$, find $n(A' \cup B')$. [4]

25. Given that $n(\varepsilon) = 50$, $n(P \cap Q) = 12$, $n(P) = 23$ and $n(P' \cap Q') = 9$, find

(a) $n(Q)$, (b) $n(P \cup Q)$. [6]

26. The Venn diagram shows the number of elements in each region of the subsets A and B of a universal set ε. Given that $n(A \cap B') = n(B \cap A')$, find



(a) $n(A \cap B)$, (b) $n(A)$,

(c) $n(A \cup B)$, (d) $n(A' \cup B')$,

(e) $n(A' \cap B')$, (f) $n(\varepsilon)$. [6]

27. Given that $n(\varepsilon) = 20$, $n(A) = 12$, $n(B) = 8$ and $n(A \cup B) = 17$, find the value of

(a) $n(A' \cup B)$, (b) $n(A \cap B')$, (c) $n(A \cap B)'$. [6]

28. A, B and C are sets such that n(A) = 5, n(B) = 7 and n(C) = 11. Find the greatest and the smallest possible values of

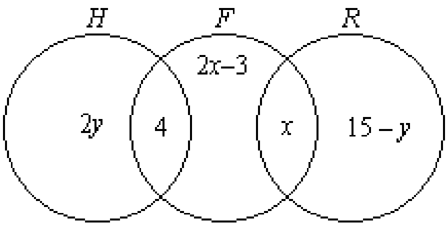
(a) n($A \cup B$), (b) n($A \cap B$), (c) n($A \cup B \cup C$),

(d) n($A \cap B \cap C$), (d) n($B \cup C$), (f) n($B \cap C$). [6]

29. Given that n(ε) = 40, n($A \cap B$) = 10, n($A \cap B'$) = 15 and n($B \cap A'$) = 8, find

(a) n(A), (b) n(B), (c) n($A' \cap B'$). [6]

30. Each of the 39 patients who consulted a doctor had at least one of the following symptoms: a running nose(R), a headache (H) and a fever (F). The Venn diagram shows the number of patients in each subset of the sets P, H and F.



(a) Express y in terms of x.

(b) Given that the number of patients who had a Headache is four times as many as those who had both a fever and a running nose, find the value of x and of y. Write down the number of patients who had a fever. [6]

31. Given that ε = {x : x is a real number and $-5 \le x \le 10$}, A = {x : $-2 \le x \le 6$} and B = {x : $-3.5 \le x \le 3.5$}, find

(a) $A \cup B$, **(b)** $(A \cap B)'$, **(c)** $A \cap B'$.

Illustrate each of the answers with a number line. [6]

32. Given that ε = { x : x is a positive even number }, A = { x : $0 \le x \le 10$ } and $B = \{x : 1 \le x^2 < 82\}$, list the elements of
(a) B, **(b)** $A \cap B$. [4]

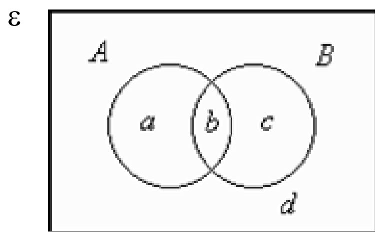
33. Given that the universal set ε is the set of positive integers, A = {x : x is prime}, B = {x : x is divisible by 3} and $C = \{x : 20 \le x \le 50\}$, list the elements of
(a) $A \cap B$, **(b)** $B \cap C$. [4]

34. Given that ε = {x : x is an integer, $2 \le x \le 15$}, $A = \{x : 22 - 3x > 3\}$ and $B = \{x : 4 < 2x \le 19\}$,
(a) list the elements of (i) A, (ii) $A' \cup B$,
(b) find the value of $n(A \cap B)'$. [6]

35. Given that ε = {x : x is a positive integer and $x < 20$}, $A = \{x : 4 < x < 15\}$ and $B = \{x : 16 < 2x - 1 < 36\}$, find
(a) $n(A \cap B)$, **(b)** $n(A \cup B')$, **(c)** $n(A' \cap B)$. [6]

36. Two sets A and B are defined as follows:
A = { (x, y) : x, y are real and $5x + 2y = 9$}
B = { (x, y) : x, y are real and $2x - 3y + 4 = 0$}
Find the value of x and of y for which $(x, y) \in A \cap B$. [4]

37. Given that ε = {x : x is an odd integer and $3 \le x \le 21$}, A = {5, 7, 9, 17, 19} and B = {3, 7, 11, 13},
(a) find the value of $n(A \cup B)$,
(b) if the sets are represented on a Venn diagram, which of the regions a, b, c and d will you place the element 11? [5]



****38.** Given that ε = {1, 2, 3, 4, 5, …, 19}, A = {x : x is prime} and B = {x : x is a multiple of 3} and C = {x : x is a factor of 12},
(a) list the elements of the sets A and C,
(b) find the value of $n(A \cup B)$ and of $n[(A \cap B) \cup C]$. [8]

****39.** Given that ε = {x : x is a positive integer}, $A = \{x : 7 < 3x < 28\}$ and $B = \{x : 3 < 2x + 1 < 25\}$and $C = \{x : 1 < \frac{x}{2} \le 9\}$
(a) list the elements of the sets A, B and C.
(b) find the value of (i) $n(A \cup B)$, (ii) $n(B \cup C)$, (iii) $n[(A \cup B) \cap C]$.[8]

****40.** A, B and C are sets such that $A \cap B = \varnothing$ and $(A \cup B)' = C$. Simplify

(a) $A' \cap B$, **(b)** $A \cup B'$, **(c)** $(A \cap C) \cup B$. [6]

****41.** Given that $\varepsilon = \{1, 2, 3, \ldots, 8, 9, 10\}$, $A = \{2, 4, 6\}$ and $B = \{1, 4, 7\}$ and $C = \{5, 6, 7, 8\}$,

(a) list the elements of $(A \cup B) \cap C'$,

(b) find the value of $n[(A \cap B) \cup C']$. [5]

****42.** Given that $A = \{x : -5 < 2x - 3 \leq 15\}$, $B = \{x : -4 \leq x + 1 < 7\}$ and $A \cup B = \{x : a \leq x - 1 \leq b\}$, find the value of a and of b. [4]

43. Given that A is a proper subset of B, simplify

(a) $A \cap B$, **(b)** $A \cup B$. [3]

44. Given that $\varepsilon = \{x : x$ is an integer less than $22\}$, $A = \{x : x$ is a prime number less than $20\}$ and $B = \{x : a < x < b\}$, find two pairs of values of a and b so that $A \cap B = \varnothing$. [4]

45. Given that $A = \{(x, y) : x + y = 4\}$, $B = \{(x, y) : x = 2\}$ and $C = \{(x, y) : y = 2x\}$, list the elements of

(a) $A \cap B$, **(b)** $B \cap C$, **(c)** $A \cap C$.

State the value of $n(A)$. [8]

****46.** Three sets A, B and C satisfy the following conditions:

$A \cap B = A$, $B \cap C = C$ *and* $A \cap C \neq \varnothing$

Represent these three sets on a clearly labelled Venn diagram. [5]

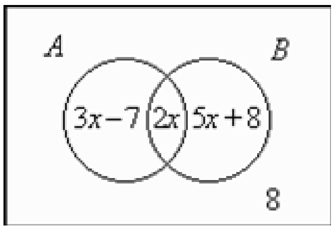
****47.** Three sets A, B and C are such that $A \cap B \neq \varnothing$, $B \cap C = C$ *and* $A \cap C = \varnothing$. Draw a clearly labelled Venn diagram to illustrate these three sets. [4]

48. A and B are subsets of the universal set ε. The number of elements in each subset are as shown in the diagram. Given that $n(A \cap B) = n(A \cap B')$, find

(a) x,

(b) $n(B')$,

(c) $n(A' \cup B')$. [6]



49. Two sets A and B are such that $n(A) = 8$ and $n(B) = 12$. If $n(\varepsilon) = 15$, find

(a) the greatest and the smallest possible values of $n(A \cap B)$,

(b) the smallest possible value of $n(A \cup B')$. [5]

50. Two sets A and B are such that n(ε) = 42 and n(A) = 18 and n(B) = 14, find

(a) the greatest and the smallest possible values of n($A \cup B$),

(b) the greatest possible value of n($A \cap B'$). [4]

****51.** Given that ε = {x : x is an integer}, $A = \{x : 0 \le x \le 5\}$, $B = \{x : -1 \le x - 3 \le 6\}$ and $C = \{x : -7 \le 2x + 3 \le 39\}$, find

(a) a and b if $A \cup B \cup \mathrm{C} = \{x : a \le x \le b\}$,

(b) n[($A \cup B$) $\cap$ C]. [5]

52. A and B are subsets of the universal set ε. If n(A) = 54 and n(B) = 63 and n($A \cap B$) = 17, find n($A \cup B$). [3]

53. In a survey of 85 Malay families, it was found that 52 families subscribe to "Berita Harian", 43 families to "The Straits Times" and 5 to neither of the two newspapers. Illustrate the above information on a clearly labelled Venn diagram and find the number of families who subscribe to both the newspapers. [6]

54. Two sets A and B are such that n(A) = 42 and n(B) = 32. If n(ε) = 60, find

(a) the smallest value of n($A \cup B$),

(b) the largest value of n($A \cap B$),

(c) the smallest value of n($A' \cap B'$).

Illustrate each of these cases with a labelled Venn diagram. [8]

Answers

1. (a) T (b) T (c) T (d) F (e) F

(f) T (g) T (h) T (i) F (j) F

2. (a) T (b) T (c) F (d) T (e) T

(f) F (g) T (h) F (i) T

3. (a) {7, 11, 13, 19, 23, 29, 31, 37, 41}

(b) {19, 23, 29}

(c) {2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 43, 47}

(d) {2, 3, 5, 7, 11, 13, 17, 31, 37, 41, 43, 47}

4. B = {1, 3, 4, 5, 6, 8, 12}

5. (a) {1, 3, 4} (b) {3} (c) {1, e} (d) {1, 3, 4}

(e) {4, 5, a, e} (f) {1, 3}

6. (a) {25}

(b) {15, 25, 35}

(c) {13, 15, 16, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 36, 37, 39}

(d) {15, 20, 25, 30, 35}

7. (a) $\{x : 4 < x \le 10\}$

(b) $\{x : -1 < x < 8\}$

(c) $\{x : -1 < x \le 4\}$

(d) $\{x : x \le 4\}$

8. (a) $\subseteq$ (b) = (c) $\subseteq$ (d) $\subseteq$ (e) $\supseteq$ (f) $\in$ (g) $\notin$ (h) =

9. (a) {2, 6, 8, 10, 12}

(b) {1, 9, 16}

(c) {3, 5, 7, 11, 13, 14, 15, 17, 18, 19, 20}

(d) {0, 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20}

10. (a) 5 (b) (i) {5, 7} (ii) {3, 9}

11. 9

12. (a) $A = B$

13. (a) $\{x : 24 \leq x \leq 32\}$ (b) $\{x : 21 \leq x \leq 36\}$

14. (a) {6, 8, 10, 12, 13, 14, 15, 16, 18, 21} (b) 2

15. (a) {2, 4, 8, 10, 14} (b) 3

16. (a) {1, 2, 3, 4, 6} (b) {1, 2, 3, 6} (c) {1, 3}

(d) {1, 2, 3, 4, 6} (e) {1, 3} (f) {1}

18. (a) {5, 7, 11} (b) 3

19. (a) 6 (b) 2 (c) 1 (d) 13 (e) 0 (f) 7

21. (a) T (b) T (c) F (d) T (e) F (f) F

22. 5

23. 20

24. 56

25. (a) 30 (b) 41

26. (a) 11 (b) 30 (c) 49 (d) 52 (e) 14 (f) 63

27. (a) 11 (b) 9 (c) 17

28. (a) 12, 7 (b) 5, 0 (c) 23, 11 (d) 5, 0 (e) 18, 11 (f) 7, 0

29. (a) 25 (b) 18 (c) 7

30. (a) $y = 23 - 3x$ (b) $x = 5$, $y = 8$; 16

31.(a) $\{x : -3.5 \le x \le 6\}$
(b) $\{x : -5 \le x \le -2$ or $3.5 < x \le 10\}$
(c) $\{x : 3.5 < x \le 6\}$

32.(a) {2, 4, 6, 8}
(b) {2, 4, 6, 8}

33.(a) {3}
(b) {21, 24, 27, 30, 33, 36, 39, 42, 45, 48}

34.(a) (i) {2, 3, 4, 5, 6} **(ii)** {3, 4, 5, …, 14, 15}
(b) 10

35.(a) 6 **(b)** 15 **(c)** 4

36. $x = 1$, $y = 2$

37.(a) 8 **(b)** c

38.(a) $A = \{2, 3, 5, 7, 11, 13, 17, 19\}$, $C = \{1, 2, 3, 4, 6, 12\}$
(b) 13, 6

39.(a) $A = \{3, 4, 5, \ldots, 9\}$,$B = \{2, 3, 4, \ldots, 10, 11\}$,$C = \{3, 4, 5, \ldots, 17, 18\}$
(b) (i) 10 **(ii)** 17 **(iii)** 9

40.(a) B **(b)** B' **(c)** B

41.(a) {1, 2, 4} **(b)** 6

42. $a = -5$, $b = 9$

43.(a) A **(b)** B

44. $a = 8$, $b = 10$, $a = 14$, $b = 16$

45.(a) {(2, 2)} **(b)** {(2, 4)} **(c)** $\{(1\frac{1}{3}, 1\frac{1}{3})\}$; ∞

48.(a) $x = 7$ **(b)** 22 **(c)** 65

49.(a) 8, 5 **(b)** 8

50.(a) 32, 18 **(b)** 18

51.(a) a = -5, b = 18 **(b)** 10

52. 100

53. 15

54.(a) 42 **(b)** 32 **(c)** 0

Chapter 11

Secondary 2 Mathematics
Chapter 11 Statistics

GENERAL NOTES

Teachers may use examples in daily life to inculcate students' appreciation of the use of averages in comparing different sets of data. If you are teaching a number of Secondary two classes, you may want your students to find out students from which class are generally taller. You may have them discuss and then decide on the appropriate average to be used for the comparison.

You may also ask the students in each class you teach to work out their mean PSLE score and the mean mark of the class for the latest test. Have them decide which class put up the best performance. The follow up of this may be the discussion of how the schools are ranked each year in terms of overall academic performance by comparing the mean subject grades (MSG) and in terms of value-added-ness by comparing the mean PSLE scores (inputs) as well as the mean subject grades (outputs).

Teachers may ask students presenting the data from some simple surveys, e.g. the number of siblings of each student, the number of students who like soccer, the number of hours spend on computer games per day and etc, on the dot diagrams and stem-and-leaf diagrams.

Important notes to students when finding median,
(1) MUST arrange the given data in ascending order.
(2) the median for an <u>odd</u> number of numbers is the middle number.
(3) the median for an <u>even</u> number of numbers is the <u>average</u> of the two middle numbers.

NE MESSAGES

No one owes Singapore a living. We must find our own way to survive and prosper.

We have confidence in our future. United, determined and well-prepared, we shall build a bright future for ourselves.

As far as NE lessons are concerned, this topic provides many opportunities for teachers to get their students to obtain some social facts about our society. Students may be asked to compare

(i) the living conditions in Singapore with neighbouring countries or other western societies.

(ii) the drinking of "new water" and ordinary water.

XYZ SECONDARY SCHOOL

Name: _________________ (   )   Date: ____________

Time allowed: min

Class: _______   Marks: $\frac{}{7}$

Secondary 2 Multiple-Choice Questions
Chapter 11   Statistics

1. If the mean and the median of the numbers 2, 3, x, x, 9, 10 where 3 < x < 9 are equal, then x is equal to

   (A) $5\frac{1}{2}$ (B) 6   (C) $6\frac{1}{2}$ (D) 7   (E) $7\frac{1}{2}$ (   )

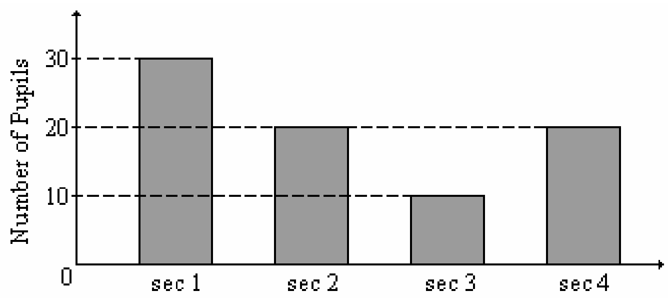
2. A pie chart is drawn to represent the language spoken by 72 workers of whom 22 speak Malay only, 32 speak Chinese only and 18 speak neither. Find the angle, in degrees, of the sector representing those speaking neither language.

   (A) 30°   (B) 60°   (C) 90°   (D) 120 °   (E) 150°

   (   )

3. If the information shown in the bar chart is represented on a pie chart, the angle of the smallest sector is

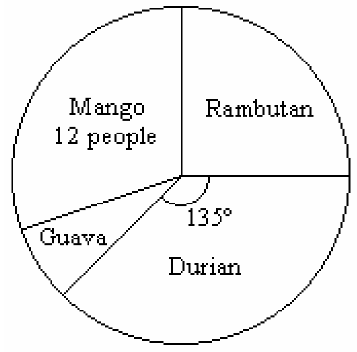
   (A) $22\frac{1}{2}°$
   (B) 45°
   (C) 60°
   (D) 90°
   (E) 108°



(   )

Questions 4 and 5 refer to the pie chart which shows the favourite fruit of a group of 40 people.

4. How many of the people like durian?
   (A) 25 (B) 20
   (C) 15 (D) 10
   (E) 5



( )

5. The ratio of the people who like mango to those who like guava is
   (A) 10:1 (B) 4:1
   (C) 1:4 (D) 10:3
   (E) 3:10

( )

6. During a season, the goals scored by a soccer team in 15 matches were as follows:

Goals scored in a match	0	1	2	3	4
Frequency	1	6	3	2	3

   The mean number of goals scored was
   (A) 1 (B) 1.5 (C) 2 (D) 2.5 (E) 3

( )

7. The mean, median and mode of the numbers 2, 3, 3, 3, 6, 6, 8, 17 are respectively
   (A) 4.5, 6, 3 (B) 6, 6, 3 (C) 6, 5, 3
   (D) 5, 6, 3 (E) 6, 4.5, 3

( )

Answers

1. B	**2. C**	**3. B**	**4. C**
5. B	**6. C**	**7. E**	

XYZ SECONDARY SCHOOL

Name: _________________ (   )   Date: ____________
Time allowed: min
Class: _______   Marks:

Secondary 2 Mathematics Test
Chapter 11 Statistics

1. The table below shows the frequency distribution of the number of grammatical mistakes made by each student in a class of 40.

Number of mistakes	0	1	2	3	4	5	6
Number of students	4	8	12	4	6	4	2

Find the (a) mean, [2]
(b) median, [1]
(c) mode of the distribution. [1]

2. The temperatures in degree Celsius (°C) each day over a three-week period were as follows:
27, 28, 30, 32, 31, 29, 26, 25, 28, 30, 31, 31, 32, 31, 29, 30, 29, 27, 26, 26, 27.
Calculate the (a) mean, [2]
(b) median, [2]
(c) mode of these data. [1]

3. The table below shows the frequency distribution of the number of school-going children per family in a small town.

Number of school-going children	0	1	2	3	4
Frequency	12	6	7	3	2

Find the (a) mean, [2]
(b) median, [1]
(c) mode of the distribution. [1]

4. A Primary 5 class consisting of 25 students was given an 8-question quiz on fractions. The following data provide the number of incorrect answers from each student:

3	1	0	0	2
4	1	5	3	0
2	6	1	4	3
3	1	2	0	1
1	2	1	3	1

(a) Copy and complete the following frequency table. [2]

Number of incorrect answers	0	1	2	3	4	5	6
Number of students	4					1	1

(b) Find the (i) mean, [2]
(ii) median, [1]
(iii) mode of the distribution. [1]

5. A car sales representative keeps track of the number of cars he sells per week.
The number of cars he sold per week in 1996 are as follows:

2	3	0	4	4	1	0	1	1	3	2	5	2
1	0	3	3	1	0	2	1	4	0	4	1	2
5	1	0	2	5	3	1	3	1	1	1	1	2
3	6	4	3	0	2	2	1	1	2	2	2	3

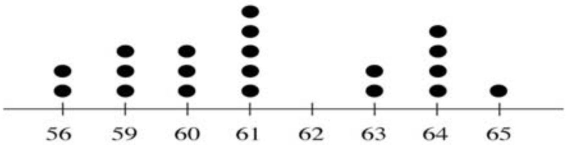
(a) Copy and complete the following frequency table:

Number of cars sold	0	1	2	3	4	5	6
Number of weeks	7			9			1

[2]

(b) Find the (i) mean, [2]
(ii) median, [1]
(iii) mode of the distribution. [1]

6. The dot diagram represents the heights, in cm, of 20 plants.



(a) What is the most common height of the plants? [1]
(b) What is the shortest height of the plant? [1]
(c) What is the percentage of plants whose height is above 62 cm? [2]

7. The following data represent the travel time in minutes from home to office of 30 company executives.

2	0	3	4							
2	6	6	7	8	9	9				
3	0	0	0	0	1	1	2	3	3	4
3	5	6	6	7	7	9				
4	0	2	8							
4	6	7								

(a) Write down the name of this diagram. [1]
(b) What is the most common travel time? [1]
(c) What is the percentage of executives who take less than half an hour to reach the office? Comment briefly on what the data indicates. [3]

8. The scores for 60 students in their attitudes towards older people are represented in the following frequency distribution.

Attitude score	10	12	13	14	15	16	17
Frequency	2	8	10	14	12	8	6

Find the (a) median, (b) mean, (c) mode. [4]

9. 400 students were asked how many hours they had spent on watching television during the preceding week. The results are represented in the following frequency distribution.

Number of hours	0	1	2	3	4	5	6	7	8
Number of students	72	106	153	40	18	7	3	0	1

Find the (a) mean, [2]
(b) median, [1]
(c) mode. [1]

10. In a survey that recorded the number of times students of a secondary two class arrived late for school, the following data resulted.

Number of times	0	1	2	3	4
Number of students	2	12	6	8	x

(a) If the mean of the distribution is $1\frac{13}{15}$, find *x*. [2]
(b) If the mode is 1, find the largest possible value of *x*. [1]
(c) If the median is 2, find the largest possible value of *x*. [2]

11. The number of illnesses suffered by secondary two students in a school is shown in the following table:

Number of illnesses	0	1	2	3
Number of students	42	15	6	2

(a) Find the (i) mean number of illnesses, [2]
(ii) median number of illnesses. [1]
(b) For 55 secondary one students from the same school, the mean number of illnesses was 1.2. Find the mean number of illnesses of the 120 students. [2]

12. The numbers 2, 6, 9, 11 and x are arranged in an ascending order. If the mean of the numbers is equal to the median, find *x*. [2]

13. 200 golfers play a certain hole and their scores are given below:

Score	2	3	4	5	6	7	8
Number of players	5	16	50	64	35	19	11

Find the (a) mean score, [2]
(b) median score, [1]
(c) modal score. [1]

14. The scores of a group of students in a test are given below:
19, 21, 20, 14, 10, 12, 11, 14, 13, 11, 16, 17, 12, 11, 10,
18, 17, 12, 14, 15, 18, 13, 12, 24, 22, 19, 21, 21, 23, 22.

(a) Copy and complete the table given. [2]

Score	Mid-value (x)	Frequency (f)	fx
10-12 13-15 16-18 19-21 22-24			
		$\Sigma f = 30$	$\Sigma fx =$

(b) Find the mean score and the modal class. [4]

15. The mean, median and the mode of 4 numbers are 37, 39 and 42 respectively. Find the mean of the largest and the smallest numbers. [4]

16. In an English test, the mean score of 40 students was 11.3. John, one of the 40 students, scored 9 marks. Later, it was discovered that John's score was recorded wrongly. After John's score was corrected, the new mean score of the 40 students became 11.4. What was John's correct score? [3]

17. 5 children have different ages. The mean age of the 3 youngest children is 4 years and the mean age of the 3 oldest children is 10 years. If the mean age of all the 5 children is 6.8 years, what is the median age of the 5 children? [4]

18.

Mark	13	14	15	16	17	18
Number of pupils	2	3	6	4	3	2

The table shows the number of students in a class who scored marks 13 to 18 in a test. Find the
(a) mean mark, [2]
(b) modal mark, [1]
(c) median mark. [1]

19. Five coins were tossed 1 000 times, and at each toss the number of heads was recorded. The results

were obtained as shown in the table below:

Number of heads	0	1	2	3	4	5
Number of tosses	38	144	342	287	164	25

(a) Draw a histogram to represent the results. [3]
(b) Calculate the mean number of heads. [2]

20. A student recorded ten measurements of the diameter of a cylinder as follows:
38.8, 40.9, 39.2, 39.7, x, 39.5, 40.3, 39.2, 39.8 and 40.6 mm respectively. Given that the mean of the measurements is 39.8 mm, find the value of x and the median of the measurements. [3]

21. The number of requests for a weekly magazine over a period of 200 weeks are shown in the following table:

Number of requests per week	5	6	7	8	9	10	11	12	13	14
Number of weeks	20	46	42	32	12	10	12	14	2	10

(a) Draw a histogram to represent the data. [3]
(b) Find the (i) mean number of requests per week, [3]
(ii) median number of requests in a week. [1]

22. The table below shows the number of goals scored in 50 football matches in a competition.

Number of goals	0	1	2	3	4	5
Number of matches	10	15	9	6	6	x

(a) If the mean number of goals scored per match is 1.9, find x. [2]
(b) If the mode is 1, find the largest possible value of x. [1]
(c) If the median is 3, find the largest possible value of x. [1]

23. The table shows the distribution of marks out of 10 scored by a group of secondary two students in a test.

Mark	0	1	2	3	4	5	6	7	8	9	10
Number of students	7	9	12	15	28	40	45	64	38	27	15

Find the (a) total number of students who sat for the test. [1]
(b) modal, median and the mean scores. [4]

24. The ages of 13 members of a club are as follows:
28, 31, 33, 31, 41, 41, 31, 42, 35, 34, 31, 25, 39
(a) State the mode. [1]
(b) Find the (i) mean , [2]
(ii) median of the thirteen numbers . [1]
(c) When a new member joins the club, the new mean age of the members is 35 years. Calculate the age of the new member. [2]

25. The marks scored by a group of students in a test were:
11, 13, 15, 15, 17, 17, 17, x, 20, 21.
Given the mean mark is 0.5 smaller than the median mark, find the value of x and state the modal mark. [4]

26. If A is the median of the numbers 39, 7, 2, 15, 18, 21, 13 and B the median of 28, 19, 15, 1, 3, 27, 7, 3, 27, 10, find the value of A-B. [3]

27 The table below displays the stem and leaf diagram of the heights of a group of students.

Stem	Leaf
15	5 5 8 8 8
16	0 0 0 0 5

(a) Show that the difference between the median and the mode of the distribution is 1. [2]
(b) Find the mean of the distribution. [2]

28 The table below shows the distribution of marks scored by students in a test.

Mark	40	50	60	70
Number of students	4	13	6	7

Find the (a) mean mark, [2]
(b) median mark. [1]

29 The number of printing errors per page in a book with 200 pages were recorded in the following table:

Number of errors	0	1	2	3	4	5	6
Number of pages	124	50	18	4	2	1	1

Find the (a) mean, [2]
(b) median, [1]
(c) mode of the distribution. [1]

30. Given the following numbers 2, 11, 16, 4, 6, 10, 13, 4, 11, 13, 5, 10, 11, 3, 16, find the (a) mode, (b) median, (c) mean. [4]

31. For the set of numbers a – 7, a – 5, a + 1, a + 3, a + 5, a + 7,
(a) obtain an expression for the median. [2]
(b) obtain an expression for the mean. [2]

Given that the mean of this set of numbers is $4\frac{2}{3}$, find the value of a. [3]

No. of microcomputers sold	0	1	2	3	4	5	6
No. of days	2	3	6	9	4	4	2

32. The table below shows the number of microcomputers a shop sold per day during a period of 30 days.

Calculate the (a) median, (b) mean number of microcomputers sold. [4]

33. The mean mark of a class of 21 pupils who sat for an English test was 56. If Alice, who obtained 36 marks, left the class, what would be the new mean mark of the class? [3]

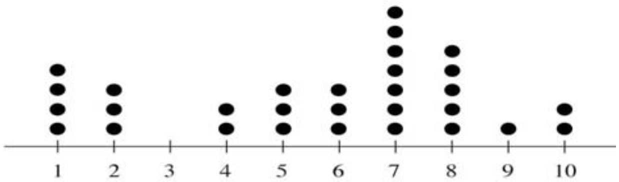
34. A bag contained five balls with each bearing one of the numbers 1, 2, 3, 4 and 5. A ball was drawn from the bag, its number noted, and then replaced. This was repeated 60 times and the table below shows the resulting frequency distribution.

Number	1	2	3	4	5
Frequency	17	13	9	10	11

For this distribution, find the
(a) mode, (b) median, and (c) mean. [4]

35. (a) Find the mean of each of the following sets of numbers
(i) 4, 7, 8, 11, 14, 16 [2]
(ii) 404, 407, 408, 411, 414, 416 [2]
(b) Given that 10.2 is the mean of 3, x, 11, 15 and 17, find x. [3]

36. The dot diagram represents the number of correct answers obtained by pupils in a Science test.



(a) How many pupils did the Science test? [1]
(b) What is the most common number of correct answers obtained by pupils? [1]
(c) What is the percentage of pupils who answer less than 5 questions correctly? [3]

37. The number of goals scored by a football team in each of the 30 matches was as follows.

2	1	3	3	0	0	4	0	1	3
3	3	2	5	1	0	1	2	0	4
0	4	1	6	2	4	1	0	5	5

(a) Complete the frequency table in the answer space. [2]

Number of goals scored	0	1	2	3	4	5	6
Number of matches			4		4	3	

(b) Find the mode, median and mean. [4]

38. The scores of a Geography test taken by 2 classes are given by the following stem and leaf diagram.

Class A		Class B
2	1	
9	2	
8	3	
9	4	
8 7	5	
7 7	6	0 0 1 2 2
9 8	7	3 4 6
8 6 5 3 3	8	0 1 2 4 5
2 1 0	9	9
9 1		1 1 4 8

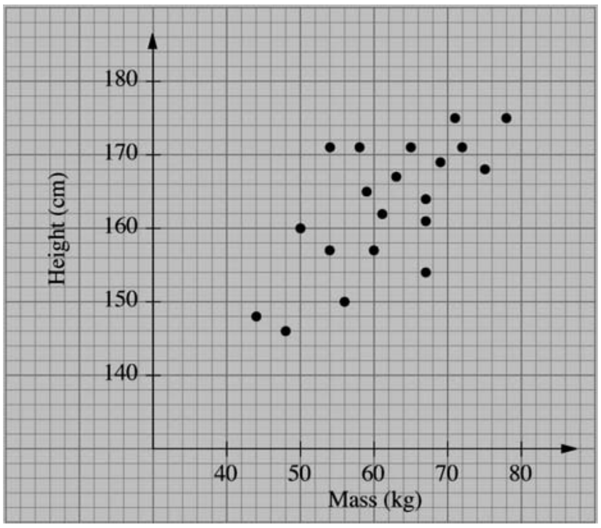
(a) How many students are there in each class? [2]
(b) How many students failed the test in each class (a score < 50) ? [2]
(c) How many students scored 90 or higher? [2]
(d) Comment on the distribution of each class. [2]
(e) How would you judge which class performed best? [2]

39. Sixty motorists were surveyed to find the amount in complete dollars spent on petrol per month. The results are displayed in a stem and leaf diagram as shown below.

Stem	Leaf
15	2 6 8
16	3 6 7 9
17	3 3 4 8 8 9 9
18	1 3 3 3 4 5 6 8 9 9
19	1 2 3 4 4 4 5 6 6 9 9
20	2 3 4 5 6 7 7 7 7 8
21	0 2 5 9 9
22	1 5 6
23	1 3 4 7
24	2 4 8

Find the mode, the median and the mean of the distribution of the monthly petrol bills of the motorists. [4]

40. The heights and masses of 20 secondary two students are given in the graph.



(a) List the 20 masses in ascending order. Using your list find the
 (i) median,
 (ii) mode,
 (iii) mean. [4]

(b) List the 20 heights in ascending order. Using your list find the
 (i) median,
 (ii) mode,
 (iii) mean. [4]

41. The table below lists the estimated hourly cost for manufacturing workers in some countries in 1999.

Country	China	Korea	Mexico	Singapore	Malaysia	Indonesia
Hourly cost US$	2.11	4.89	1.52	7.32	2.59	0.09

(a) How many times more expensive is a Singaporean worker's cost per hour as compared to his Indonesian counterpart? [3]

(b) Express the percentage difference of the hourly cost of a Singaporean worker compared to his Malaysian counterpart taking the hourly cost of a Malaysian worker as the base. [3]

(c) A multinational company employs 32 workers in China, 45 workers in Korea, 65 workers in Singapore, 67 workers in Mexico, 87 workers in Malaysia and 43 workers in Indonesia. Calculate the mean and median hourly cost of the workers employed by the company assuming that the workers in each country earn the same average hourly pay. [4]

42. The weights, in kg, of 50 boys were recorded as shown in the table below:

Weight (kg)	$40< x \leq 45$	$45< x \leq 50$	$50< x \leq 55$	$55< x \leq 60$	$60< x \leq 65$	$65< x \leq 70$	$70< x \leq 75$
Number of boys	4	5	10	14	8	6	3

Copy and complete the table below and hence find the mean weight of the 50 boys. [5]

Weight (kg)	Mid-value (x)	Frequency (f)	fx
$40< x \leq 45$			
$45< x \leq 50$			
$50< x \leq 55$			
$55< x \leq 60$			
$60< x \leq 65$			
$65< x \leq 70$			
$70< x \leq 75$			
		$\Sigma f =$	$\Sigma fx =$

43. The table below shows the distribution of ages of the members of a club.

Age (years)	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	1	2	16	18	9	4

(a) Construct a histogram to represent the distribution. [3]

(b) Calculate the mean age of the members of the club. [2]

(c) State the modal class. [2]

Answers

1. (a) 2.5 (b) 2 (c) 2

2. (a) 28.8 (b) 29 (c) 31

3. (a) 1.23 (b) 1 (c) 0

4. (a) 8, 4, 5, 2 (b) (i) 2 (ii) 2 (iii) 1

5. (a) 15, 12, 5, 3 (b) (I) 2.06 (ii) 2 (ii) 1

6. (a) 61 cm (b) 58 cm (c) 35%

7. (a) Stem and leaf diagram (b) 30 mins (c) 30%

8. (a) 14 (b) 14.2 (c) 14

9. (a) 1.66 (b) 2 (c) 2

10. (a) 2 (b) 11 (c) 11

11. (a) (i) 0.51 (ii) 0 (b) 0.83

12. 17

13. (a) 5.05 (b) 5 (c) 5

14. (b) 16 , 10-12

15. 35

16. 13

17. 8 years

18. (a) 15.5 (b) 15 (c) 15

19. (b) 2.47

20. $x = 40$ median = 39.75

21. (b) (i) 8 (ii) 7

22. (a) 4 (b) 14 (c) 33

23. (a) 300 (b) 7, 6, 6.02

24. (a) 31 (b) (i) 34 (ii) 33 (c) 48

25. 19, 17

26. 2.5

27. (b) 158.9

28. (a) 55.3 (b) 50

29. (a) 0.59 (b) 0 (c) 0

30. (a) 11 (b) 10 (c) 9

31. (a) a + 2 (b) a + $2\frac{2}{3}$, 4

32. (a) 3 (b) 3

33. 57

34. (a) 1 (b) 2.5 (c) $2\frac{3}{4}$

35. (a) (i) 10 (ii) 410 (b) 5

36. (a) 30 (b) 7 (c) 30%

37. (b) 0, 2 , 2.2

38. (a) 20, 20 (b) 4, 2 (c) 2 (e) Class A

39. (a) \$207 , \$194.50 , \$197.18

40. (a) 44,48,50,54,54,56,58,59,60,61,63,65,67,67,67,69,71,72,75,78
(i) 62 kg (ii) 67 kg (iii) 61.9 kg

(b) 146,148,150,154,157,157,160,161,162,164,165,167,168,169,171,171,171,171,175,175
(i) 164.5 cm (ii) 171 cm (iii) 163.1 cm

41. (a) 81⅓ (b) 183% (c) mean = US\$3.23 median = US\$2.59

42. 57.2 kg

43. (b) 53.8 (c) 50-60

Chapter 12

Secondary 2 Mathematics
Chapter 12 Probability

ANSWERS FOR ENRICHMENT ACTIVITIES

Just For Fun (pg 362)

$$\frac{5}{6}.\frac{5}{6}.\frac{5}{6}+\frac{5}{6}.\frac{5}{6}.\frac{5}{6}.\frac{5}{6}.\frac{5}{6}.\frac{1}{6}+(\frac{5}{6})^8.\frac{1}{6}+(\frac{5}{6})^{11}.\frac{5}{6}+..........$$

$$=\frac{25}{216}[1+\frac{125}{216}+(\frac{125}{216})^2+(\frac{125}{216})^3+........]$$

$$=\frac{25}{216}\{\frac{1}{1-\frac{125}{216}}\}=\frac{25}{91}$$

Secondary 2 Mathematics
Chapter 12 Probability

GENERAL NOTES

We will only deal with problems on probability involving single events in this chapter. More complicated problems will be introduced when we reach Secondary 4.

The theory of probability originated from gambling. Refer to page 363 for a short history. We can ask the pupils to do a small research on the history of probability. With the coming of IR to Singapore in 2009 and 2010, pupils will be more exposed to the gambling scene. It would be good to educate our pupils on the odds of gambling. Mathematically, is it worthwhile to gamble? When we gamble, do we know how much our $1 is betting against the House (the operator or casino). NE messages could also be infused when we teach this lesson.

1. Begin the lesson by telling the class that you are teaching them how to gamble. (Show a set of playing cards, a few dice, some coins, 4-Digit betting slips and TOTO and soccer betting slips etc. This will arouse their interest as most pupils will not expect a teacher to teach them how to gamble).
2. To play a trick on the pupils: Tell the class that you are giving them a chance to gamble with you as you have a simple game that most of them can understand. Take a coin and show the action of throwing and catching the coin. Then tell them that the rule is very simple and they can bet a couple of dollars if they wish. The rule is simply: “Heads I win, Tails you lose”. Teacher is to tell it in a normal but clear manner and instruct pupils, “OK, you can place your bet now.” Some pupils will fall to your the trap but most of them will be able see through your trick after digesting carefully the terms said and they will accuse you of trying to cheat them. Let the whole class see the implication of the statement just said. Then proceed to the next step.
3. Teacher to tell pupils, “Since all of you do not want to play the game using the rules I just mentioned, I’ll modify the rule: “Heads I win and Tails, you win” OK?” Their answer will definitely be OK. Then you proceed to add the following condition. “Since I introduce this game to you and I have spend lots of time and effort, and to get permission to operate it, this small rule will be added to compensate my extra effort. “If you place a $1 bet and when it comes down Heads, I’ll win $1 and if comes down Tails then I’ll pay you 70 cents.” Most of the pupils will cry foul play.
4. You can then say, “All of you think I am out to cheat you? Right? And most of you will not play with me, right? By the way how many of your parents do bet on 4D or TOTO or Big Sweep?” There will definitely be some pupils who will put up their hands and then you can proceed to ask, “Do you know the theoretical payout?” To add some fun to the lesson you can then teach them the method to shade the betting slips. (You can collect some of these betting slips from any Singapore Pools outlet, pass these down so that everyone knows how it looks like, if possible let everyone have a slip and shade them as

you so through). You can show the procedure of shading more easily by using the visualiser. Show them how to buy BIG and SMALL.

5. Now you can then ask the pupils if they know the payout amount if they buy $1 BIG and $1 SMALL. Don’t be surprise if some of them know the answer. According to the Singapore website (Singaporepools.com.sg) the payouts are as follows:

Bet Amount $1	BIG	SMALL
1st prize	$2000	$3000
2nd prize	$1000	$2000
3rd prize	$490	$800
Starters prize	$250	$0
Consolation prize	$60	$0

If your class has internet access connection you can show them the website and calculate the prize money to be won.

6. You can ask them, “How to ensure that you can win the 1st, 2nd and 3rd prizes in the draw for 4-D SMALL?” Give pupils this explanation: One way is to buy all the numbers possible. How many numbers will there be? One will need to buy numbers from 0000, 0001, 0002, 0003 ……….. 9997,9998 and 9999. That makes a total of 10000 and you will need to pay $10000. Of course nobody will do it this way, but at every draw will there people in Singapore who will buy 0000, 0001….1234, 3456, 8888….? It is possible that all the 10000 numbers will be bet on by different people in Singapore at every draw. Now to win the 1st, 2nd and 3rd prizes of the draw one has to pay $10000 but the total winning will only be $3000+$2000+$800 (i.e. $5800 ONLY). In another words your $1 is betting against $0.58 from Singapore Pools. That is, for every dollar he bets, he gets only 58 cents in return. Some pupils will point out that no single person will be so stupid as to bet on all the possible numbers. You may point out that for the whole of Singapore there will always be punters who bet on each of the 10 000 possible numbers. This explains why the 4-D operators are forever the big winners. As for an individual punter if he bets on ′SMALL′ 4-D tickets long enough, theoretically, he is expected to lose 42 cents for every dollar he puts in. The pupils may be convinced that it is after all not a good habit to bet on 4-D.
7. Now let’s work out how much your $1 will be betting against Singapore’s money? You can go through the same process as in (6) above. (The answer is $0.659).
8. You can now tell the pupils that by offering to pay them 70 cents when they win, you have been very generous and not all out to cheat them!
9. Here’s a bit of National Education that you can add. As the Singapore Pools is a government-controlled and non-profit commercial organisation, most of the surplus are used for charity purposes such as sponsoring educational causes, sports events to promote sports in Singapore, TV programmes to help to fight crime and many others. So it is advised that if one has to gamble it is advisable to bet through Singapore Pools and not through illegal bookies as the profits gained by these bookies will only benefit themselves. Thus when

one bets through legal means through Singapore Pools, one is also doing "Charity work". Of course these may be a bit "Ah Q". As the IR will be coming up in Singapore very soon, if one really cannot resist from gambling, it is better to bet in Singapore than in Casinos in other countries as part of the profits will be channel back to the government coffers in the form of business generated and taxes that the operators pay to the government.

10. You can tell the pupils to inform their parents which of the 4-D system, BIG or SMALL should they bet on?
11. You can also get the pupils to do a mini project by asking them to find out what are one's $1 is betting against Singapore Pools' when one bets on TOTO, Singapore Sweep?
12. You can also show some of the slides regarding gambling in the newspapers and hopefully that will help them to come to the realisation that a gambler will always be on the losing end when one bets with gambling operators. In fact, most of the games played in casinos are not fair games. They are to the advantage of the casinos only. For each game, with the help of probability, a value which indicates the bettor's expected gain should be zero.

XYZ SECONDARY SCHOOL

Name: ________________ (   )   Date: ____________

Time allowed: min

Class: _______   Marks: $\frac{}{8}$

Secondary 2 Multiple-Choice Questions
Chapter 12 Probability

1. In a class of 40 pupils, 18 are boys. 12 of the girls and 8 of the boys passed a Mathematics test. If a boy is selected at random, the probability that he passed the test is

   (A) $\frac{1}{5}$ (B) $\frac{6}{11}$ (C) $\frac{4}{9}$

   (D) $\frac{11}{20}$ (E) none of the above (   )

2. In a class of 42 pupils, 24 are boys and 8 of the girls wear glasses while 16 of the boys wear glasses. If a pupil is selected at random, find the probability that the pupil is a boy who does not wear glasses.

   (A) $\frac{2}{3}$ (B) $\frac{8}{21}$ (C) $\frac{4}{21}$

   (D) $\frac{4}{7}$ (E) none of the above. (   )

3. A two-digit number less than 50 is chosen at random. The probability that the number chosen is a perfect square is

   (A) $\frac{7}{50}$ (B) $\frac{2}{25}$ (C) $\frac{7}{40}$

   (D) $\frac{1}{10}$ (E) none of the above. (   )

4. There are 20 lorries, 120 cars and 60 vans in a public car park. If two lorries left the car park, what is the probability that a third vehicle leaving the car park is also a lorry?

   (A) $\frac{1}{11}$ (B) $\frac{1}{10}$ (C) $\frac{9}{11}$

   (D) $\frac{9}{10}$ (E) none of the above. (   )

5. There are 35 yellow marbles and x white marbles in a bag. When a marble is picked, the probability that the marble is yellow is $\frac{5}{8}$. The value of x is

(A) 15 (B) 25 (C) 21
(D) 28 (E) none of the above. ( )

6. A bag contains 40 blue and yellow balls. When a ball is selected at random, the probability that it will be a blue ball is $\frac{3}{8}$. An additional 9 blue balls and 31 yellows are added to the bag. The probability that a ball selected at random from the bag will be a blue ball is equal to

(A) $\frac{23}{40}$ (B) $\frac{17}{40}$ (C) $\frac{7}{10}$
(D) $\frac{3}{10}$ (E) none of the above. ( )

7. A box contains 8 red pencils, 10 blue pencils and 6 black pencils. A pencil is selected at random from the box. The probability that the colour of the pencil selected is not black is

(A) $\frac{3}{4}$ (B) $\frac{1}{3}$ (C) $\frac{5}{12}$
(D) $\frac{1}{4}$ (E) none of the above. ( )

8. A card is drawn at random form the cards shown below.

P	R	O	B	A	B	I	L	I	T	Y

The probability that the card selected has a vowel on it is

(A) $\frac{7}{11}$ (B) $\frac{4}{11}$ (C) $\frac{5}{11}$
(D) $\frac{6}{11}$ (E) none of the above. ( )

Answers

1. C 2. B 3. D 4. A 5. C 6. D 7. A 8. B

XYZ SECONDARY SCHOOL

Name: _________________ (   )   Date: ____________

Time allowed: min

Class: _______   Marks:

Secondary 2 Mathematics Test
Chapter 12 Probability

1. A box contains 8 red balls, 6 blue balls and 5 green balls. A ball is picked at random from the box. Find the probability of picking
   (a) a green ball, [2]
   (b) a red or a blue ball. [2]

2. The probability that our school's soccer team will win a game is $\frac{5}{11}$ while the probability that our opponent will win is $\frac{3}{11}$. What is the probability that the game will end in a draw? [4]

3. The table below shows the marks obtained by the pupils of a secondary 2 class in a Mathematics test.

Mark	40-49	50-59	60-69	70-79	80-89
No. of pupils	5	7	8	12	8

   A pupil is selected at random, find the probability that the pupil scored
   (a) less than 50 marks, [2]
   (b) more than 60 marks. [2]

4. All the letters of the word PROBABILITY are put inside a bag. A letter is drawn at random from the bag. What is the probability that the letter selected is
   (a) the letter B, [2]
   (b) a vowel, [2]
   (c) not the letter K, [2]
   (d) the letter M? [2]

5. A four-digit number is chosen at random. What is the probability that the number is
(a) divisible by 4, [2]
(b) divisible by 9, [2]
(c) a multiple of 13? [2]

6. A coin and a dice are thrown at the same time. List all the possible outcomes of the event. Find the probability of obtaining
(a) a head and a prime number on the dice, [2]
(b) a tail and a number which is a multiple of 3. [2]

7. Bag A contains 8 red balls and 7 blue balls. Bag B contains 4 red balls and 5 blue balls. A ball is selected at random from Bag A and put it into Bag B. Find the probability that
(a) Bag A has equal number of balls of the same colour, [2]
(b) Bag B has more blue than red balls. [2]

8. A two-digit number is written down at random. What is the probability that the number written is
(a) divisible by 3, [2]
(b) a multiple of 5, [2]
(c) smaller than 17? [2]

9. A box contains the following cards bearing the numbers *1, 2, 3, 5, 7, 9, 11, 13, 14, 15, 17, 18, 19, 21, 23* and *25.* A card is selected at random. Find the probability that the number on the card is
(a) a prime number, [2]
(b) a multiple of 3. [2]

10. The table below shows the grades of the pupils in an English test.

Grade	A	B	C	D	E	F
No. of students	35	43	84	58	24	16

A student is selected at random. Find the probability that the student selected scored
(a) grade A, [2]
(b) grade C or D, [2]
(c) a grade higher than a C. [2]

11. A shopping centre did a survey to find out the colour preference of the shoppers. The table below illustrates the results of the survey.

Colour preference	Yellow	Red	Blue	Peach
No. of shoppers	145	245	155	265

A shopper is selected from the above group of people. Find the probability that the colour preference of the shopper is

(a) blue, [2]

(b) yellow or peach, [2]

(c) white. [2]

12. A box contains 60 identical marbles where x of them are red while the rest are yellow. If a marble is drawn and the probability that it is white is $\frac{1}{12}$, find the value of x. How many white marbles must be added to the box so that the probability of choosing a white marble is $\frac{5}{16}$?

Answers

1 (a) **(b)**

2 $\frac{3}{11}$

3 (a) **(b)**

4 (a) $\frac{2}{11}$ **(b)** $\frac{4}{11}$ **(c)** **1** **(d)** **0**

5 (a) $\frac{1}{4}$ **(b)** $\frac{1}{9}$ **(c)** $\frac{1}{13}$

6 **H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6** **(a)** $\frac{1}{4}$ **(b)** $\frac{1}{6}$

7 (a) $\frac{8}{15}$ **(b)** $\frac{7}{15}$

8 (a) $\frac{1}{3}$ **(b)** $\frac{1}{5}$ **(c)** $\frac{7}{90}$

9 (a) $\frac{9}{16}$ **(b)** $\frac{5}{16}$

10 (a) $\frac{7}{52}$ **(b)** $\frac{71}{130}$ **(c)** $\frac{49}{130}$

11 (a) $\frac{31}{162}$ **(b)** $\frac{41}{81}$ **(c)** 0

12 $x = 55$, 20